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Nuclear Science Abstracts

Vol. 4 No. 13
July 15, 1950

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Vol. 4 No. 13

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BIOLOGY AND MEDICINE

3840 A New Ether Anesthesia Apparatus for Small Animals. Thomas J. Haley and Reginald W. Dickinson. UCLA-66, Apr. 17, 1950. 8p.

An anesthesia apparatus, which can be built from readily available materials, is described. This piece of equipment enables the investigator to maintain a relatively constant control over the depth of ether anesthesia in rats and guinea pigs, thus facilitating the completion of surgical preparation of such animals. (auth)

3841 Bone as a Problem in Surface Chemistry. W. F. Neuman. UR-110, Mar. 22, 1950. 27p.

Experimental investigation has demonstrated four distinct chemical processes related directly to the surfaces of the bone mineral: isoionic exchange, heteroionic exchange, recrystallization, and lattice growth. While none of these processes is, in itself, unexpected or unusual, the magnitude of the active surface is unique. In some preparations, 1 out of 5 calcium ions in the bone was capable of exchange. This represents a surface thousands of times greater than expected from particle-size measurements. Under such circumstances, surface activity must contribute a major share of the total chemical properties of the bone. These properties undoubtedly have an important bearing on many aspects of calcification. With respect to the chemical nature of the bone mineral, x-ray diffraction evidence (Bale, Am. J. Roentgenol., 43, 735(1940)) indicates that bone samples from a variety of sources and experimental conditions give a common pattern analogous to that given by the hydroxyl apatites. This can be taken to mean that the crystalline material in bone is made up predominately of a specific spatial arrangement of calcium, phosphate, and hydroxyl ions. It seems unlikely that heteroionic substitution in the interior of the crystal could take place to any appreciable extent without destroying the lattice arrangement; the requirements of ionic charge, ionic volume, and bond angles are too rigorous. It can be concluded, therefore, that the interior of the crystals has a fixed composition. Spatial requirements at the surface are not so limited, however, and, as seen experimentally, the crystal surfaces may undergo marked changes reflecting the composition of the medium in which it is suspended. The few foreign, bone-seeking elements which have been studied from the "surface" point of view have proved to be fixed in the skeleton by a mechanism involving ionic exchange. A clearer knowledge of the surface properties of bone is necessary for adequate control of experiments in calcification. Nearly every experiment involves manipulation and pretreatment of the bone mineral. Undoubtedly the outcome of the experiments depends on the condition of the specimen. For example, ashing procedures cause crystal growth and markedly reduce the subsequent recrystallization and ionic-exchange potentialities of the specimen. At present it is not possible to state what these surface properties mean in terms of physiological function. Certainly, they serve to emphasize the dynamic nature of the calcified structures. Bone cannot be considered to be a stable system in which the inorganic phase is inert. The tissue fluids of an adult man literally flow over acres of active inorganic surface. It is not surprising that the inorganic composition of the body fluids varies only slightly. The apparent stability of the skeleton can be attributed only to extremely efficient excretory mechanisms which automatically balance variations in inorganic intake. 10 references.

BIOLOGY AND MEDICINE

3842 Quarterly Progress Report No. 4 on Radiobiology. University of Chicago Toxicity Laboratory. TID-364, Jan. 15, 1950. 88p.

This report is composed of sections entitled as follows: Continuous Exposure of Animals to Gamma Radiation; The Toxicity of Gamma Radiation to Mice Exposed at Varying Dose Rates; Changes in the Distribution of Phosphorus in Irradiated Rabbit Bone Marrow; Studies on the Metabolism and Toxicity of Radioactive Metals; Studies on the Mechanism of Acute Beryllium Poisoning. III—The Effects of Beryllium on Phosphatases and on Intermediary Carbohydrate Metabolism; Studies on the Carbohydrate Metabolism of the Rabbit Ileum; The Effects of Beryllium Chloride in Locke-Ringer Solution upon the Isolated Rabbit Ileum and Heart; Effect of X-Radiation on Intestinal Cathepsins; Effect of Vitamin B 12 on X-Ray Toxicity to Mice; Further Studies on the Action of Beryllium Chloride; Some Notes on the Sampling of Aerosols by Impaction Methods.

3843 Irradiation Responses in Daphnia Magna. I. Increased Resistance to X-Irradiation under Low Oxygen Tension. Edward E. Held and Albert W. Bellamy. UCLA-69, Apr. 20, 1950. 10p.

Daphnia magna exposed to x-rays under conditions of oxygen depletion show a marked increase in resistance to the irradiation. The increased resistance is evident both from survival curves and productivity records. (auth)

3844 Calculation of the Energy Deposition by Fast Neutrons in Soft Tissue. J. H. Tait. Brit. J. Radiology 23, 282-6(1950) May. (See also NSA 4-19.)

The dose in roentgens (rep) is calculated at interior points of a semi-infinite space consisting of human tissue for the case when a broad monochromatic collimated beam of neutrons falls perpendicularly upon the free surface. The variation of the mean free path with energy is neglected, and with this approximation the physical effects can be shown to be proportional to the neutron energy flux. This latter quantity is then determined as a function of the distance into the tissue, using the spherical harmonics P_7 approximation. (auth)

3845 Chromosomal Rearrangements from Exposure to Radiation. A. E. Longley. Maize Genetics Coöp. News Letter (Cornell) 24, 7-8(1950) Mar. 17.

An analysis of chromosomal arrangements resulting from exposure of corn seeds to the Bikini explosion and to control x-ray treatment is briefly outlined. The chromosome and chromosome arm breaks produced by the various dosages and sources were not distributed at random. The nonrandom distribution in the Bikini-treated material was different from that of the controls.

3846 Comparison of Dosage Distributions Obtainable with 400 kVp X Rays and 22 Mev X Rays. H. E. Johns, E. K. Darby, T. A. Watson, and C. C. Burkell. Brit. J. Radiology 23, 290-9(1950) May.

The clinical possibilities of combinations of various dose distributions of radiation from a 22-Mev betatron are considered and compared to dosimetry of conventional x-ray generators operating at 400 kv. Following a description of the betatron, the authors give dosimetry curves for single fields with x-rays filtered by 4 mm of Cu at a focal distance

BIOLOGY AND MEDICINE

3847 Effect of X-ray Radiation on Hypersensitiveness. Leo H. Criep, Lloyd D. Mayer, and Sheldon G. Cohen. J. Allergy 21, 269(1950) May.

This paper deals with the authors' experience in the evaluation of the effect of x-ray radiation on the development of diffuse vascular disease (collagen disease), on the Arthus phenomenon, on the Schultz-Dale reaction, and on the production of precipitins in sensitized animals. The experiment indicates that interference with the function of the reticulo-endothelial system depresses precipitin titers, completely abolishes the Arthus phenomenon, and interferes with the production of diffuse vascular changes so obviously present as a result of sensitization in untreated animals.

3848 Experimental Hypersensitivity in the Rabbit. Louis Schwab, Frederick C. Moll, Thomas Hall, Henry Brean, Marjorie Kirk, Clinton Van Zandt Hawn, and Charles A. Janeway. J. Exptl. Med. 91, 505-26(1950) May 1.

The experiments described here involve the investigation of the inhibition of antibody formation by x-radiation, the relationship between complement and serologic sequences, and the relationship between complement, serologic sequence, and histologic changes. In the first experiments several rabbits were subjected to 150 to 400 r per dose of x-rays, delivered 5 to 8 times at interval of several days, both before and after the intravenous injection of whole bovine serum or bovine serum γ globulin. Tests for the presence of antigen and antibody were made 9 to 28 days later. Similar experiments were performed with nitrogen mustard instead of the x-radiations. Serum complement determinations, as well as tests for the presence of antigen and antibody, were made in subsequent experiments on rabbits. Other experiments are also described. It was found that x-radiation and nitrogen mustard inhibit the formation of precipitins for whole bovine serum and bovine serum γ globulin in the rabbit. Other data presented are interpreted as evidence in favor of the concept that the lesions seen are due to a reaction between antigen fixed in or on tissue cells and circulating antibody. The possible significance of serum complement in the pathogenesis of anaphylactic tissue lesions is discussed. 68 references.

3849 Genetic Effects of Radiations. D. G. Catcheside. Advances in Genetics 2, 271-358(1948).

A comprehensive review of recent data concerning the influences of radiation in genetical processes is presented. The topics discussed under separate titles are: The Radiations; General Cytological Effects of Radiations; Types of Structural Change; Sequence of Induced Structural Change in the Mitotic Cycle; Quantitative Relations; Time of Split of Chromosomes; Mechanism of Induction of Chromosome Structural Changes; Relative Efficiencies of Different Radiations; Structural Change in Drosophila; Production of Mutations by Radiations; Recessive Lethal Mutations in Drosophila; Other Mutagenic Agents; Cosmic Rays and Mutations; Radiations and Gene Size; The Nature of Sex-linked Recessive Lethals in Drosophila; Dominant Lethals; The Nature of Visible Mutations; and Genetical Effects of Ultraviolet Light. 81 references.

3850 Histological Changes Produced by a Single Large Injection of Radioactive Phosphorus (P^{32}) in Albino Rats and in C3H Mice. B. Grad and C. E. Stevens. Cancer Research 10, 289-96(1950) May.

BIOLOGY AND MEDICINE

Twenty-two normal young male and female albino rats and eight adult female C3H mice received a single large dose of radiophosphorus, P^{32} (0.5 to 4.0 mc), and were sacrificed from 2 hr to 9 days later. The cellular destructions consisted mostly of pyknosis and karyorrhexis of mitotic nuclei. The cytoplasm of damaged cells showed vacuolation and reduced staining ability. The destructive effects of P^{32} were most marked in the lymphatic organs and bone marrow, the small intestine, granulosa of ovarian follicles, and mammary tumors. In the crypts of the small intestine, massive degeneration and pyknosis of dividing cells resulted in thinning of the epithelium of crypts and villi, probably because no new cells were supplied from the crypts to balance the continual loss of cells by extrusion normally occurring at villi tips. The mammary tumors showed many scattered pyknotic cells at 24 hr after injection; at 48 hr, large blood lakes had formed without much tissue damage; at 9 days, most of the tumor was necrotic and liquefied. Lesser changes were noted in the stomach and colon, in the seminiferous tubules of the testis, and in the hair follicles; little or no damage was observed in the salivary glands, pancreas, liver, genito-urinary system, endocrine glands (except the ovary), brain, and muscular and connective tissue. (auth)

3851 Influence of Cosmic Radiation on Experimental Tuberculosis. S. G. Ong. Ann. Inst. Pasteur 76, 406-14(1949) May (in French).

This article is similar to one published in Nature 163, 244(1949) which was listed in Nuclear Science Abstracts as Abstract 2-1844.

3852 Irradiation Experiment. H. C. Eyster. Maize Genetics Coöp. News Letter (Cornell) 24, 15-17 (1950) Mar. 17.

Sweet corn kernels, irradiated with slow neutrons and γ rays from a Ra-Be source behind paraffin, produced phenotypically normal plants. Self-pollination produced progeny, all of which showed variation, some of the variants being further transmissible as bona fide mutants.

3853 Irradiation of Small Volumes by Contained Radioisotopes. Paul I. Richards and Benjamin A. Rubin. Nucleonics 6, No. 6, 42-9(1950) June.

This paper treats the problem of radiation dosage where the average path length of the emitted β particle is a significant fraction of the dimensions of the volume being internally irradiated. A calculation of this type is particularly useful when considering the decay of radioactive substances within small organisms. The fraction of ionizing energy escaping from a slab is calculated for low-energy radiation (nonuniform energy loss in slab) and for very energetic radiation (uniform energy loss) and is plotted as a function of S/R, where S is the slab thickness and R the range. Other special cases are considered, i.e., strips long compared to R with width $b < R$ and $S \ll b$; the correction to this for smaller strips; thin circular disk of thickness $S \ll$ (radius) $r < R$; the case where one dimension of the body is large compared to R but the other two are R or less; the case where all dimensions are small, but the deviations

from sphericity is an elongation rather than a flattening. 11 references.

3854 Procedure in Dose Distribution Measurement of 25-Mev X-rays. J. S. Laughlin and W. D. Davies. Science 111, 514-16(1950) May 12 (Technical paper).

In preparation of a 25-Mev betatron for human therapy and animal experimentation, extensive measurements of depth-dose and isodose distributions were made under a variety of conditions. Two general techniques were employed, one based on measurements with small ionization chambers and the other on x-ray film density response. The ionization measurements were carried out in a remote-controlled water phantom whose construction and mode of operation are described in detail. A series of measurements of the dose-density relation of industrial x-ray films established a linear relation $r = \text{const} \times D$ for type A and type M films, where D refers to the net density measured with an electronic densitometer employing a photocell and amplifier, and r refers to the dose as recorded by a Victoreen thimble chamber.

3855 Response of Field Grown Tomatoes to Radioactive Materials. R. E. Larson, B. L. Pollack, and H. K. Fleming. Agr. Expt. Station, State College, Pa., Progress Rep. No. 27, 1-3(1950) Mar.

Tomato plants were fertilized with α-emitting Alphatron and Alphatrol (Scientific Souls Products, Inc., New York, N. Y.). Statistical analyses indicate no significant response from any of the treatments used.

3856 Biochemical Oxygen Demands of Radioactive Sewage (Progress Report). Rolf Eliassen, Werner N. Grune, Theodore Jaffe, and A. N. Diachishin. NYO-1510, Mar. 1950. 77p.

In this report the first findings of the effect of radioactivity on sewage are reported. Thus far, no real significance can be attached to these findings, pending further investigations and additional laboratory runs. Under investigation and reported herein are the reaction rate constant of the biochemical oxygen demand of sewages, the dilution water used for this purpose, nitrification, and both first- and second-stage observations, all compared to the possible effect that radioactivity might have on these when discharged as a waste product. P^{32} was used as the source of radioactivity in these experiments. (auth)

3857 Epilation by X-Rays. H. K. Zink. Strahlentherapie 80, 399-406(1949)(in German).

A review on epilation by means of x-rays is given, and the question of quality, intensity, and dosages is discussed. Sixty-four children, 3 to 15 years old, with mycosis of the head were treated. The irradiation was delivered by a 90-kv machine, with a 0.5-mm Al filter, at 48 r/min and at a focal distance of 22 cm; the total dosage was 65.5% of the skin erythema dose. In 4 unsuccessful cases the negative results were attributed to an increasing resistance of the hair capillaries (with age and development) toward radiation. It is suggested that the necessary smallest dosage for epilation of the hair in children be decided by a consideration of the age, development, weight, size, and presence or absence of puberty in the subject. 44 references.

3858 Perforation of a Gastric Ulcer Following Intensive Radiation Therapy. William Feiring and Morris L. Jampol. New England J. Med. 242, 751-3(1950) May 11.

A case of severe reaction to intensive radiation of the epigastrium followed by the development and perforation of a gastric ulcer is presented. The x-rays were delivered by a 200-kv machine with a filtration of 0.5 mm of Cu plus 1 mm of Al, at a focal distance of 50 cm, and over a period of about 5 weeks; the total surface doses were 2,500 r to the right suprapubic and right lumbar fields and 2,750 r to the right epigastric field. During the last 10 days of exposure, erythema and desquammation of the right groin, diarrhea, and a temporary depression of the white cell count occurred. Three days after the completion of the therapy, severe diarrhea and vomiting ensued, and desquammation and erosion of the skin extended to involve the whole treated area; drenching sweats, dehydration, pallor, and apprehensiveness became prominent. Despite the gravity of the gastrointestinal manifestations that immediately succeeded the treatments, x-ray studies did not reveal any ulceration of the stomach or duodenum. Yet 2 months later an acute perforation of the stomach developed. The possibility of gastric ulceration and perforation after intensive radiation of the epigastrium is to be considered as one of the hazards of treatment.

3859 Personnel Monitoring. Gerard Leifchild. X-ray Technician 21, 337-40(1950) May.

A general discussion of x-ray personnel monitoring is presented. The chief reasons for this monitoring are: protective barriers may be inadequate, improper work methods may be used by laboratory technicians and helpers, and rank carelessness may occur on the part of the personnel. Three types of treatment are available for the measurement of ionization: electroscopes of the Lauritsen type (pocket meters and pocket chambers), ionization chambers with associated electronic equipment, and Geiger-Mueller tubes with associated electronic equipment. The author confines his discussion to the first-named category. Several suggestions for the proper use and care of pocket meters and chambers are outlined: always keep the meter charged when not in use; before use, determine the loss of charge due to ionization from cosmic radiation and other sources, and find out whether the instrument is operative or not; the instrument should be given reasonable care to preserve it from breakage.

3860 The Use of Radioactive Static Eliminators in a Printing Plant. Irving L. Berman and Eugene P. Ernest. Ind. Med. and Surg. 19, 229-30(1950) May.

One type of radioactive static eliminator used in the printing industry is described, and its potential hazards are discussed. The necessary precautions to prevent dangerous exposure to α, β, and γ radiation and radon are outlined. Some of these include: a quick-acting device for attaching the static eliminator to the presses; shields surrounding the static eliminator, which should be kept in place when the press is not in use; the removal of the units whenever work has to be done within 20 in. of them for longer than 1 hr; and the use of gloves when cleaning the eliminator and the application of clean abrasive-free clothes in order

to prevent scratching of the protective metallic coating covering the radioactive source.

3861 The Nature and Therapy of Radiation Sickness. A. M. Brues. Chicago Med. School Quart. 11, 105-8(1950) Apr.

A description is presented of some of the symptoms present in humans after atomic irradiation. Leucopenia, epilation, sterility, and keloids are mentioned in connection with the chronic and acute forms of radiation sickness. Such methods of therapy as blood transfusion, injection of toluidine blue, general supportive measures, and injections of antibiotics are named and outlined. Pretreatment with cysteine and phenylhydrazine is mentioned; the radiosensitivity of tissues and genetic mutation are briefly considered.

3862 Pathophysiological Effects of Total Body Irradiation. Elizabeth E. Painter. Chicago Med. School Quart. 11, 96-9(1950) Apr.

The author describes various pathophysiological effects of total-body irradiation. Some of the physiological and biochemical alterations occurring after exposure to ionizing radiation appear to result from direct damage to the tissue concerned, while others result from indirect effects by agents carried in the blood from one region of the body to another; the signs and symptoms are similar with every kind of ionizing radiation. A list is included which covers the single total-body dosage of x-rays needed to kill 50% of the animals involved. The characteristic phases in the radiation-effect pattern (initial shock, acute period, subacute period, and chronic period) are discussed under separate headings. The total-body dosage either of 25, 50, 100, or 200 r is correlated with such specific effects in the guinea pig, dog, rabbits, and rats as lymphopenia, granulocytopenia, reduction in the platelet count, reduction in blood pressure, elevation of basal metabolism, inhibition of intestinal absorption of glucose, elevation of sedimentation rate, anemia, absence of reticulocytes, and prolongation of clotting time.

3863 Beta Radiation in Industrial Ophthalmology. A. D. Ruedemann, M. D. Trans. Am. Acad. Ophthalmol. Otol. 391-2(1950) Mar.-Apr.

Radon, radium D applicators, and radioactive isotopes are used in cases of corneal scarring due to industrial accidents. Very dense lesions are treated with the radium D applicators for periods of not less than 5 min with good results both in obtaining improved vision and in ameliorating corneal vascularization, photophobia, and lacrimation; special mention is made of the improved cosmetic appearance even when vision is not appreciably improved.

3864 Chemotherapy of Thyrotoxicosis. S. B. Barker. Interne 14, 283-8(1948) Nov.

A brief sketch is presented of the action of thyroid-inhibiting agents in relation to concepts of the physiology and biochemistry of the gland. I^{131} administration in single doses of 1,000 to 2,000 μc, which is repeated after a few weeks if the patient's response requires it, has been applied successfully to Graves' disease and in diagnosis of various thyroid conditions. Radioiodine therapy is contraindicated in cases of the types of thyroid cancer which are incapable of concentrating iodine.

3865 Hidrosadenitis Axillaris and Its Roentgen Treatment (Optimum Total Dose and Intensity). N. Lauge-Hansen and S. Lyndrup. Acta Radiol. 31, 129-44 (1949).

This article is similar to one which appeared in Nord. Med. 41, 220(1949) (Roentgen Treatment of Hydrosadenitis Axillaris) and was abstracted in Nuclear Science Abstracts as Abstract 4-2193.

3866 Medical Uses of Radioactive Isotopes. Leonidas Marinelli. Chicago Med. School Quart. 11, 100-4 (1950) Apr.

This is a general discussion of radioisotopes in medicine, including their applications in basic research and in radiation therapy. Examples of work in these fields, using radioactive isotopes of Na, Fe, I, and P, are illustrated by discussion of several cases of neoplastic disease.

3867 Multiple Possibilities of Application of an Artificial Radioactive Isotope (Co^{60}) in Fluid Form for Roentgentherapy of Malignant Tumors. J. H. Müller. Gynaecologia 128, 47-8(1949)(in German).

This article is similar to one which appeared in Schweiz. Med. Wochschr. 79, 547(1949) and was abstracted in Nuclear Science Abstracts as Abstract 3-554.

3868 Radioiodine As a Diagnostic and Therapeutic Tool in Clinical Medicine. S. M. Seidlin. Recent Progress in Hormone Research 4, 483-510(1949).

The author concentrates on the work done by his group in relation to cancer of the thyroid. He emphasizes clinical applications of radioiodine in the diagnosis and therapy of thyroid disease.

3869 Report on Radium Therapy for 1948. Robert E. Fricke and Harry H. Bowing. Proc. Staff Meetings Mayo Clinic 24, 420-3(1949) Aug. 3.

Tables are given which show the number of cases of each type, both malignant and nonmalignant, which were treated with x-ray, radium, or radon seed therapy during 1948. In the series reported, 2,803 treatments were given to 886 patients in 1,006 treatment series; the total number of patients seen and/or treated was 2,136. Beta irradiation was also used for cases of corneal ulcers, leukoma, pterygium, and keratitis with good immediate results; P^{32} therapy showed good results in the cases of polycythemia vera, and I^{131} was used with good results in the therapy of exophthalmic goiter and some selected cases of cancer of the thyroid.

3870 Review of Belgian Work Published Since 1936 on the Cancer Problem. Paul Desaive. Archiva med. Belg. 4, 321-56(1949)(in French).

Salient points are covered in consideration of: oncological investigations; heredity; physical agents, including radiation from radioactive substances; carcinogenic substances, including radioisotopes; the etiology of cancer; the diagnostics of cancer; metastatic formations; chemotherapy of cancer, including the use of radioisotopes such as P^{32}; and some general considerations of the action of radiations, including radium, x-ray, and radioisotopes.

3871 Review of Belgian Work Published Since 1936 on the Cancer Problem. Paul Desaive. Archiva med. Belg. 4, 457-83(1949)(in French).

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This is a continuation of a previous article (Archiva med. Belg. 4, 321(1949)) covering the salient points from the literature in considerations of the pathology and special therapeutics of cancer, including various types of radiation therapy. The following special types or sites of the malignancy are discussed: tegumentary, digestive tube, the glands near the digestive tube, the respiratory tract, the mediastium, the urinary bladder and associated structures, male and female genital tracts, the mammary gland, nervous tissue, the spleen and thymus, Hodgkin's disease and similar conditions, leukemic states, bone tumors, the endocrine glands, cervical and subclavicular reticulo-endotheliomas, and retroperitoneal tumors.

3872 Ten-Year Cures and Late Effects with Radiotherapy in Malignant Tumors of the Upper Respiratory and Alimentary Tracts. H. R. Schinz and A. Zuppinger. Oto-Rhino-Laryngologica 10, 61-84(1948)(in German).

In 73 cases of malignant tumors of the upper respiratory and alimentary tracts treated with radiotherapy, recurrence-free periods exceeding 10 years were observed after the therapy. The radiotherapeutic dosages were usually not followed by late skin or mucous membrane sequelae, and carcinoma or sarcoma secondary to irradiation did not occur. Radium needles were applied in one case of lingual and in one case of gingival tumor, combined with operation, and radium needles only were applied to one lingual and to one labial tumor; a radium mold was applied in one case of tumor of the soft palate. Fractional radium irradiations were applied in 45 cases over a protracted period, and protracted, fractional x-ray irradiation was administered in 13 cases of nonoperated or recurrent malignant tumors. Other techniques were also applied.

3873 Treatment of Far Advanced Malignancy: Report of Four Cases in Children. G. M. Tice. J. Kansas Med. Soc. 51, 225-9(1950) May.

Four cases of advanced malignancy are reported, all of which have been followed for from 10 to 17.5 years. None of them show tumor evidence at present. Treatment was primarily x-ray or x-ray and radium irradiation in each case. In each case there has been radiation damage to a degree. In two cases, young people have prematurely lost their teeth. In one case there may have been sufficient effect on the normal pituitary to produce diabetes insipidus. In one case there was an esophageal stricture, doubtless due to radiation, and in one case of malignant tumor of the antrum there was a complete breakdown of the soft tissue and bone of the face overlying the antrum. (auth)

3874 The Treatment of Chronic Myelogenous Leukemia. Sara A. Courts. J. Bowman Gray School Med. Wake Forest College 8, 87-94(1949) June.

After a discussion of the etiology of chronic myelogenous leukemia, the author considers the use and dosage of various therapeutic agents such as arsenic, benzol, nitrogen mustards, urethane, aminopyrine, and radiation, including the use of P^{32}. X-irradiation in doses beginning at 50 r and gradually increasing to 200 r are given over the spleen, mediastinum, and affected lymph nodes by a 125-kv machine with a filtration of 2 to 6 mm of Al, at a rate of 1 to 5 times a week, with the dosage determined by the blood picture, symptomatic response, and metabolic rate. Contraindications and therapeutic complications are also discussed.

3875 The Treatment of Exophthalmic Goiter with Radioiodine. Samuel F. Haines. Chicago Med. Soc. Bull. 52, 969-70(1950) May.

More than 100 patients were treated by the author and his colleagues for exophthalmic goiter with radioiodine, I^{131}. In each case a tracer dose of the isotope was first administered to determine the amount of iodine which could be collected and retained by the thyroid. The majority of the patients were then treated with a dose of about 250 μc/g (estimated) of thyroid tissue. The total doses used for the treatment of Graves' disease were 2,600 to 20,000 μc. The results were satisfactory, except that a fairly high percentage (probably 30%) of the patients later developed myxedema. No other reactions were noted.

3876 The Treatment of Myoma Uteri. Robert A. Kimbrough. North Carolina Med. J. 10, 529-32 (1949) Oct.

Methods are discussed for the treatment of myoma uteri and consist of radiation therapy, hysterectomy, and myomectomy. A total dosage of about 1,800 mg-hr of radium was administered to a number of patients in the author's clinic, and 96% of these patients responded satisfactorily. Contraindications for the radiation therapy were the young age of the patient, the presence of tumors larger than a three months' pregnancy, the presence of pain, the presence of pedunculated tumors, fear of radiation by the patient, extreme nervousness, uncertainty of diagnosis, a rapid increase in size of the tumor, associated endometrial hyperplasia, and the presence of postmenopausal tumors or anemia out of proportion to the blood loss.

3877 Treatment of Skin Tumors. Alfred Reisner. Strahlentherapie 79, 373-82(1949) 3(in German).

After discussing the value of the different radiation methods available for the treatment of malign and benign skin tumors, the author's own methods and results for the treatment of skin tumors are described. Almost 100% healing results over a period of three years were obtained with tumors no larger than 2 cm in diameter and 3 mm in depth by short-distance irradiation with a caustic total dosage of 4,000 r. Tumors of 2 to 4 cm in diameter could be healed in 94% of the cases over the same period when 4,000 r was delivered and followed 1 to 3 days later with 2,000 r. Larger tumors received short-distance irradiation of 1,000 r daily, after an initial dosage of 2,000 r, until the total dosage was 8,000 to 12,000 r. In these cases the healing rate was about 77 to 83%. Of 16 patients with tumors of the lip, 14 were healed for more than three years. Of 225 cases of angioma, where beeswax moulages with radium needles were applied, 83% demonstrated cosmetically satisfactory results. Of the children treated, 47% needed one radiation series, 38% needed two, and 15% needed more than two; usually the total dosage was 1,000 to 1,200 r, which was administered over three sittings of ½- to 1½-hr lengths, within 1 to 2 weeks. Keloids were radium-treated with moulages in three sittings every 2 to 3 days until the total dosage was 1,200 to 1,400 r; where necessary, this was repeated 2 to 3 times after 2 to 3 weeks. Plastic induration of the penis was treated with

moulages in three sittings every 2 to 3 days until a total dosage of 1,200 to 1,400 r was administered. In 30% of the cases improvement was achieved.

3878 The Therapeutic Use of BAL in Polonium Toxicity. John B. Hursh. AECD-2852, July 12, 1949. Decl. May 16, 1950. 64p.

British anti-lewisite (BAL) and related dithiol compounds have been tested for their effects on the toxicity of polonium in rats. When polonium is injected intravenously, BAL, the most effective of the dithiols tested, approximately doubles the 10-day excretion of polonium. Where polonium is injected subcutaneously, BAL is less effective than BAL acid (NDR 317) or the urea derivative of BAL (NDR 399). The tissue-distribution results show that the BAL rats at 10 days have consistently higher polonium concentration in muscle than do the control rats. If BAL is given as a single intramuscular injection 1 hr after intravenous polonium administration, the polonium concentration in the whole blood is very sharply decreased. Tissue distribution of polonium 3 hr post-administration is given for BAL and control rats. These data show that BAL mobilizes polonium from the blood into the muscle, intestine, and kidney. Twenty rats were injected with a dose of polonium (36 μc/kg) which was known to be associated with a median survival time of about 25 days. Ten rats were treated with intramuscular BAL. Records were kept of survival time, daily weight, and periodic blood-sample findings. The treated rats had a median survival time of 82 days, as contrasted with a median survival time of 21 days for the untreated rats. The data appear to indicate that the therapeutic effect of BAL is related to both the increased excretion of polonium and to the shift of polonium to less radiosensitive tissues. 12 references. (auth)

3879 Atomic Energy Commission Project at Boyce Thompson Institute. P. W. Zimmerman, A. E. Hitchcock, Richard Weed, Henry Kirkpatrick, and Irene Zachar. M-4475, Apr. 11, 1949. 19p.

Results are reported for an investigation to determine the toxic effects of uranyl nitrate (SC-5), uranium tetrafluoride (TA-7), and uranium dioxide (LF-9), the movement of these chemicals in plant stems and other tissues, the amounts stored in various tissues, quantities causing injury, and tolerance of different species. The three compounds were applied to plants in a variety of ways.

3880 Acute Inhalation Toxicity of Beryllium. I. Four Definite Studies of Beryllium Sulfate at Exposure Concentrations of 100, 50, 10, and 1 Mg. Per Cubic Meter. Herbert E. Stokinger, George F. Sprague III, Robert H. Hall, Norman J. Ashenburg, James K. Scott, and L. T. Steadman. Arch. Ind. Hyg. Occupational Med. 1, 379-97(1950) Apr.

The first of a series of comprehensive studies on beryllium exposure is presented; the studies were conducted in order to determine the safe level for exposure to the metal and its compounds. Four experiments are reported, one pilot study and three short-term acute-exposure studies on a variety of animal species. In the pilot study relatively few tests for toxic response were employed other than weight response, mortality, and pathologic anatomy. In the short-term studies, exposures

to successively lower concentrations were made, and more extensive biochemical, physiological, and hematological tests were employed; rats, dogs, cats, rabbits, guinea pigs, monkeys, goats, pigs, hamsters, mice, and chickens were exposed to beryllium sulfate mists. The details of the experimental procedures and the individual results are presented. It was found that acute beryllium poisoning with pulmonary lesions closely resembling those in man was produced in those animals exposed to daily inhalation of the beryllium sulfate mist; no transition of this response to the lesions of chronic granulomatosis developed at any level after more than three months exposure. Indications of such responses as anemia resembling the macrocytic type, changes of blood cell concentrations, and disturbances of nitrogen metabolism were found. The type of pulmonary response was little changed by decreasing the concentration from the 100- and 50-mg levels to the 1-mg level. It is concluded that there is sufficient evidence to assume that the toxic manifestations observed are the result of the action of beryllium itself and not mainly the results of the associated anions of its acidic salts. (auth)

3881 Air Pollution and the Particle-Size Toxicity Problem—II. H. E. Stokinger and S. Laskin. Nucleonics 6, 15-31(1950) Mar. (See also NSA 4-1353.)

Part I of this paper reviewed the health hazards caused by air-borne particles, with primary emphasis on those chemically toxic materials used in atomic-energy production. Here attention is directed to methods and instruments of recent origin that are especially suited to solve these problems. Included are (1) the filter-paper dust sampler and the electrostatic precipitator for quantitative estimation of particulate concentration, (2) the "Modified Cascade Impactor" and the oscillating thermal precipitator for characterization of particle-size distribution, (3) surface-coating techniques and the electron microscope as improved methods of resolution and measurement, (4) the "Penetrometer" and the "Owl," indirect optical methods for characterization of particulates, and (5) low-temperature ethane adsorption for the measurement of surface area. 36 references.

3882 An Antagonism between Trypaflavine and Lanthanum Ions. L. Massart. Arch. intern. pharmacodynamie 79, 490-2(1949) June 1.

Experiments were performed which, the author concludes, show that La ions are powerful reversers of the inhibition of the respiration of baker's yeast caused by trypaflavine. The experiments are described in detail; it was found that La^{+3} and trypaflavine compete for the same cellular substances, since centrifugation of yeast cells with trypaflavine throws down yellow- to brown-colored cells where centrifugation in the presence of La ions shows feebly colored cells. The author concludes that the results can be explained by a cation exchange between the trypaflavine and the La cations.

3883 Beryllium Granulomata in the Lungs of Rats. T. A. Lloyd Davies and H. E. Harding. Brit. J. Ind. Med. 7, 70-2(1950) Apr.

This article is a discussion of the granulomata formed in the lungs of rats injected with BeO. The authors emphasize

that beryllium granulomata in the lungs is associated with the rate of solution of the particles, which is determined by the particle size and solubility of the beryllium compound.

3884 The Effect of Adrenocorticotropic Hormone (ACTH) on Beryllium Granulomatosis. (A Preliminary Report). B. J. Kennedy, J. A. P. Pare, K. K. Pump, and R. L. Stanford. Can. Med. Assoc. J. 62, 426-8 (1950) May.

Adrenocorticotropic hormone (ACTH) was administered to a patient with beryllium granulomatosis. A striking improvement occurred as evidenced by the clinical response and the changes noted in the x-rays and respiratory-function studies. Remissions in beryllium granulomatosis have not occurred with the use of other agents, and regressions such as demonstrated in this patient are regarded as unlikely to occur spontaneously. The response of this patient to ACTH demonstrates a temporary improvement and suggests that this disease is reversible. Follow-up studies are necessary to determine the duration of improvement. 12 references.

3885 Medical Hazards of Beryllium. G. Riddell Royston. Practitioner 164, 391-6(1950) May.

The primary symptoms and clinical manifestations of beryllium poisoning are described, and some preventive measures are discussed. Nasopharyngitis and tracheobronchitis result from exposure to fumes of beryllium and invariably precede pneumonitis; acute pneumonia may occur within a few hours after exposure, but more commonly it has an insidious onset some weeks or months later, but while the subject is still exposed to the beryllium. The treatment is symptomatic and consists of oxygen therapy in the more severe cases. The sulfonamides and the antibiotics are useless; the antihistamines have been found useful by some investigators. Chronic cases of beryllium poisoning, called "chronic pulmonary granulomatosis" cases, are characterized by a delayed onset; the symptoms are similar to these seen in acute pneumonitis but, in addition, weight loss is marked and accompanied by anorexia. Dyspnea is very prominent, together with fatigue; hemoptysis has been reported, with diminished vital capacity and orthopnea. No specific treatment has as yet been discovered. Beryllium affects the skin in two ways: contact dermatitis results from the contact with the soluble salts and is characterized by an edematous papulovesicular eruption chiefly over the exposed surfaces, accompanied by considerable pruritis; beryllium ulcers or granulomas result from the implantation of a crystal of a beryllium salt into or under the skin. Harmless substitutes should be used for beryllium when possible; when beryllium must be used, protective measures such as exhaust systems, masks, and protective clothing should be utilized, together with a regular physical examination and chest x-ray. 23 references.

3886 A New Problem of Industrial Hygiene: Glucinium or Beryllium Intoxications. René Truhaut. Ann. pharm. franç. 8, 124-48(1950) Feb. (in French).

A complete discussion is presented of beryllium intoxication in both acute and chronic forms, including consideration of the following topics: etiology, metallurgy of Be, the manufacture of fluorescent tubes, various uses of Be,

symptomology of intoxications, prophylaxis, analytic properties of Be substances, toxicological applications of various biological complexes, chemical and spectroscopic analytical methods, and localization and elimination of Be with special reference to tracer studies.

3887 Preliminary Report on the Toxic Effect of Uranium to Paramecium Caudatum. Edwin H. Shaw, Jr., Elaine Nelson Ordal, and Frank J. Wingfield. Proc. South Dakota Acad. Sci. 28, 121-7(1949) Dec. 1.

Cultures of Paramecium caudatum were treated with various concentrations of uranyl acetate at pH 7, death time being plotted against molarity. The similarity of the resulting curve to that of a bimolecular chemical reaction, going to partial completion, is pointed out. Cytological changes are described.

3888 The Application of Isotope Techniques to Biological Problems. A. Robert Goldfarb. Chicago Med. School Quart. 11, 87-90, 109(1950) Apr.

The application of isotopic atoms as tracers in biological problems is based on two assumptions: living organisms cannot distinguish between most isotopes, and the isotopic concentration in tissue is constant. Some requirements of tracer studies are: the initial concentration of the tracer element that is being used must be sufficiently great so as to withstand dilution effects; the isotope must, under non-metabolic conditions, remain bound in a stable manner; the presence of a labeled atom must not interfere with metabolic processes; and the half-life of the isotope must be sufficiently long so as to permit carrying out the experiments. Use of the tracers is made in intermediary metabolism to determine whether the administered materials are absorbed, utilized, and localized. Great accuracy and specificity may be obtained in analytical techniques by using isotopic dilution procedures. Examples of utilization of tracers in permeability studies and metabolic turnover rate experiments are presented.

3889 Are Phospholipins Transmitted through the Placenta? G. Popják and Marie-Louise Beeckmans. Biochem. J. 46, 99-103(1950) Jan.

Three rabbits, on the 18th, 23d, and 28th day of pregnancy, were injected with serum containing phospholipids labeled with P^{32}, and the radioactivity of phospholipids was compared with that of inorganic phosphorus in the maternal liver, fetal placenta, fetal liver, and carcass. It was found that the fetal placenta absorbed more phospholipid from the circulation than the maternal liver, but it did not transmit unhydrolyzed phospholipid molecules to the fetus. Glycerophosphate, which is the first phosphorus-containing degradation product of lecithin in tissues, also did not pass unhydrolyzed through the placenta. The placenta of the 18th-day pregnant rabbit was more active than that of the 28th-day pregnant animal in the absorption and degradation of phospholipid. The cells of the 18-day-old rabbit embryo were uniformly permeable to phosphate ions, whereas in the 23- and 28-day-old fetuses a condition more approaching that in adult animals was found. 11 references. (auth)

3890 The Biogenesis of Porphyrins; The Distribution of ^{15}N in the Ring System. Helen M. Muir and A. Neuberger. Biochem. J. 45, 163-70(1949).

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A synthesis of methylethylmaleic acid imide and of hematinic acid imide, two oxidation products of mesoporphyrin, is described. The ultraviolet absorption spectra in water and the dissociation constants of these and related compounds have been determined. The oxidation of mesoporphyrin by chromic anhydride was investigated, and conditions were established which permit the isolation of the two maleic acid imides on a micro scale. This method was applied to the degradation of mesoporphyrin obtained from rabbits fed glycine containing an excess of N^{15}. The results show that the acidic and nonacidic pyrrole nuclei in hemin have the same or closely similar isotope ratios. Ethanolamine containing an excess of N^{15} was fed to rats; the hemin obtained had a much lower N^{15} content than that of control animals which had received a slightly smaller amount of labeled glycine. It is concluded that the nitrogen of ethanolamine is not used to any marked extent in the synthesis of protoporphyrin. 25 references. (auth)

3891 The Conversion of Hematin to Bile Pigment. Irving M. London. J. Biol. Chem. 184, 373-6(1950) May.

In order to provide direct evidence on the conversion of hematin to bile pigment, a normal dog was injected intravenously with 800 mg of N^{15}-labeled hematin in divided doses on 3 consecutive days, and the stools were collected for 9 days; stercobilin was isolated from the stools, and its N^{15} concentration was analyzed. The preparation of the labeled hematin is described. The isotope concentration in the stercobilin was found to be 0.325 at. % excess N^{15}, representing the conversion of approximately 18% of the total amount of labeled hematin to bile pigment in 9 days. 16 references.

3892 Deuterium and Its Significance in Problems of Chemistry and Biology. Prof. Dr. Chomse. Monatsh. Veterinärmed. 4, 191-3(1949) Oct. (in German).

Some of the differences in behavior between H^1 and H^2 are discussed. The degrees of difficulty with which various molecules and radicals accept H^2 in place of H^1 offer a means for studying molecular structure and metabolic processes. Mice, given heavy water in their diet, produced children and grandchildren with considerable percentages of H^2, indicating that a substantial part of body substance is retained throughout life.

3893 The Effect of Dietary Oleic and Palmitic Acids on the Composition and Turnover Rates of Liver Phospholipins. I. G. Campbell, June Olley, and M. Blewett. Biochem. J. 45, 105-12(1949).

An investigation has been made of the amounts of liver lipid accumulating during the feeding of rats with large amounts of pure saturated and unsaturated fatty acids. Low-protein high-fat diets containing pure oleic and palmitic acids were fed to rats; analyses were made of carcass and liver lipids and liver phospholipids; P^{32} was employed in the measurement of phospholipid turnover rates. The metabolism of large amounts of dietary palmitic acid is accompanied by the simultaneous release of large amounts of depot fat; the metabolism of oleic acid does not impose a similar demand on the fat depots. A correlation has been found between the amount of liver lipid expressed on a dry-weight basis and the amount of radioactivity per unit of liver inorganic phosphate 4 hr after the injection of radiophosphate. Phospholipid turnover rates, measured with P^{32}, show no correlation with amounts of liver lipids or with gross changes in fat metabolism caused by palmitic acid feeding. This indicates to the authors that either phospholipid turnover rates may not be involved or the rate of turnover of radioactive phosphate is not a measure of that of the fatty acid on the phospholipid molecule. The factors causing liver lipid accumulations in animals fed diets containing large amounts of saturated fatty acids are discussed. 27 references. (auth)

3894 Fixation of N_2^{15} by Excised Nodules of Leguminous Plants. Shirley R. Tove, H. F. Niss, and P. W. Wilson. J. Biol. Chem. 184, 77-82(1950) May.

Experiments to test the possible presence of a nitrogen-fixing contaminant in excised nodules of leguminous plants were performed with the aid of N_2^{15}; it was found that the nodules from soy-bean and cow-pea plants grown in nitrogen-poor soil under the usual nonsterile greenhouse conditions or outside the cold frame frequently contained species of the nitrogen-fixing anaerobe, Clostridium. Although the anaerobe might be present, excised nodules did not commonly fix enough nitrogen to be detected even by the isotopic tracer method used here; the presence of oxygen, numbers of contaminants, and especially a supply of soluble combined nitrogen apparently controlled the process.

3895 The Formation of Bile Pigments in Pernicious Anemia. Irving M. London and Randolph West. J. Biol. Chem. 184, 359-64(1950) May.

An untreated 51-year-old subject with symptoms of pernicious anemia was given 48 g of glycine containing an excess of N^{15} over the course of 48 hr; the glycine was fed hourly in equal doses. The hemin and stercobilin were isolated. The results indicated that in untreated pernicious anemia a large part of the bile pigment is derived from one or more sources other than the hemoglobin of mature, circulating erythrocytes. 18 references.

3896 Further Studies of the Biogenesis of Porphyrins in Rabbits. Helen M. Muir and A. Neuberger. Biochem. J. 45, xxxiv(1949).

Rabbits were injected with the three following isotopic compounds $N^{15}H_2C^{14}H_2COOH$, $C^{14}H_3COOH$, and $CH_3C^{14}OOH$. The blood porphyrin was isolated and degraded by oxidation, and the relative activities of the three fragments, methylethylmaleic acid amide (derived from rings I and II), hematinic acid (from rings III and IV), and CO_2 (mainly derived from the methyne carbon atoms), were found. The results indicate that most, if not all, of the methyne bridge carbon atoms are derived from the original glycine. In experiments using isotopic acetates it was found that the utilization of the methyl group of methyl-labeled acetate was found to be considerably more efficient than the utilization of the carboxyl group of the carboxyl-labeled acetate. The implications of these and other results are discussed.

3897 Future Development of U.S.D.A. Research Program. Frank W. Parker. Agr. Chemicals 4, 28-30, 93 (1949).

The U.S. Department of Agriculture is developing the use of radioisotope tracer technics as part of its research pro-

gram. Most of the work to date has been concerned with development of methods and studies of phosphatic fertilizers, using P^{32}. Future work will include additional development work, additional elements such as Ca and micronutrients, and fundamental and applied studies of agricultural chemistry, soils, fertilizers, and crops.

3898 Handbook of Radioactivity and Tracer Methodology. William Siri, et al. U. S. Office of Technical Services Report PB-93615. 900p.

This comprehensive book, published by the Office of Technical Services, is divided into three sections covering nuclei and radioactivity, the measurement of radioisotopes, and biological and medical applications of isotopes. It is expected that this book will become a standard reference in laboratories where isotopes are used.

3899 Influence of Alpha-Naphthylthiourea (ANTU) on Iodine Metabolism. Richard U. Byerrum, Kenneth W. Cochran, and Kenneth P. DuBois. Proc. Soc. Exptl. Biol. Med. 73, 661-4(1950) Apr.

Total, inorganic, and organic iodine contents of the tissues of normal and alpha-naphthylthiourea (ANTU)-poisoned Sprague-Dawley rats were measured with the aid of I^{131}: The dose was 10 μc administered intraperitoneally. ANTU decreased the thyroid iodine of rats and guinea pigs and caused a small increase in the total iodine of blood and lung when acutely toxic doses of the rodenticide were administered. Feeding a high-iodine diet for 5 days caused a marked increase in the total iodine of tissues from normal and thyroidectomized rats. Since pretreatment of thyroidectomized rats with iodine does not afford protection against ANTU, the increase in thyroid iodine of normal iodine-fed rats appears to be involved directly in the prophylactic effect of iodine against ANTU poisoning. (auth)

3900 The Metabolic Activity of the α-, β-, and γ-Hydrogen Atoms of L-Leucine and the α-Hydrogen of Glycine. David B. Sprinson and D. Rittenberg. J. Biol. Chem. 184, 405-16(1950) May.

L-Leucine labeled with deuterium in the α, β, and γ positions and N^{15} in the amino group and glycine labeled with deuterium on the methylene carbon atom and N^{15} in the amino group were prepared. Degradative carbon atom and N^{15} in the amino group were prepared. Degradative procedures were worked out for the determination of the deuterium concentration at the α, β, and γ positions of leucine. After the administration of the leucine and glycine to rats, leucine and hippuric acid were isolated from the tissue proteins and urine, respectively. Since the β- and γ-deuterium atoms of leucine had undergone similar dilutions, as compared to the N^{15}, it appears that α, β-dehydrogenation of this amino acid had not occurred. The α-deuterium atom of the carcass leucine and of the hippuric acid experienced greater dilutions than the N^{15}, and some possible causes for this lability are discussed. (auth)

3901 The Metabolism of Sulphapyridine Containing Radioactive Sulphur in the Rabbit. H. G. Bray, G. E. Francis, F. C. Neale, and W. V. Thorpe. Biochem. J. 46, 267-71(1950) Mar.

Sulphapyridine containing S^{35} was synthesized; metabolic experiments with this compound in the rabbit demonstrated that there is no complete catabolism to inorganic sulfate and no significant retention of the drug in the tissues after 3 days. Differences between the values obtained by assays of S^{35} and diazotizable material suggested the formation of a metabolite which does not diazotize or couple normally, but this has not yet been isolated. (auth)

3902 The Monoiodotyrosine Content of the Thyroid Gland. Alvin Taurog, W. Tong, and I. L. Chaikoff. J. Biol. Chem. 184, 83-97(1950) May. (See also NSA 4-619.)

A technique for the quantitative fractionation of the iodine-containing components of a thyroid hydrolysate by filter-paper partition chromatography is described. The presence of monoiodotyrosine, in addition to diiodotyrosine and thyroxine, in the thyroid of the rat, chicken, and sheep was confirmed with the aid of I^{131} as a tracer. Hydrolysis of the thyroid tissue with either 2N NaOH or 8% $Ba(OH)_2$ led to a fairly extensive breakdown of thyroxine. Monoiodotyrosine comprised approximately 15% of the total iodine in the hydrolysate of rat thyroid and approximately 20% in that of chicken thyroid; diiodotyrosine comprised approximately 30% of the total iodine in the hydrolysate of rat gland and about 25% in that of chicken gland. The authors conclude that the method described here does not appear to be suitable for the quantitative estimation of thyroxine; 3,5-diiodothyronine appears to be absent from the rat thyroid. 21 references. (auth)

3903 The Nature of Plasma Iodine as Revealed by Filter Paper Partition Chromatography. Alvin Taurog, I. L. Chaikoff, and W. Tong. J. Biol. Chem. 184, 99-104(1950) May.

Plasma obtained from rats that had been injected 24 hr earlier with I^{131} was extracted with butanol, and the nature of the organic I^{131}-containing components of the extract was examined by filter-paper chromatography. The position taken by the major radioactive component, as determined by radioautographs of the filter paper, corresponded exactly to that of thyroxine carrier as determined by color test. The organic iodine of plasma, therefore, appears to be identical with thyroxine. (auth)

3904 A Note: A Study of the Utilization of Phosphorus in Green Manure Crops by the Succeeding Crops, Using Radioactive Phosphorus. Joe L. White, Maurice Fried, and A. J. Ohlrogge. Agron. J. 41, 174-5 (1949).

P^{32} was used to measure the magnitude of the direct contribution of P in a green manure crop to the nutrition of a succeeding crop. Alfalfa was grown on a high level of P containing P^{32}; the alfalfa tops were then harvested and incorporated into 2-gal pots of Crosby silt loam and white silica sand. The efficiency of organic versus inorganic sources of P was compared by adding an amount of inorganic P (KH_2PO_4) equivalent to the total P added in the green manure treatment to the soil and sand treatments; sudan grass was used as the succeeding crop. The above-ground portion of the sudan grass was harvested 4 weeks after planting, and the P^{32} in the plant material was determined. The results

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of the experiment indicate that the green manure was as effective a source of P as the inorganic P on the P-deficient Crosby silt loam. The percentage utilization of both inorganic and organic sources of P was very low on the Crosby silt loam, averaging 3%. The per cent utilization values for the sand treatment were 3 to 5 times greater than that for the soil. The per cent of P in the plant derived from the applied P was approximately 76% for the soil treatments and 97% for the sand treatments.

3905 The Nutritive Value of Nitrogenous Compounds for Ruminants. II. The Formation of Body Protein from Urea Labeled with the Isotope N^{15}. Cyril J. Watson, W. M. Davidson, and J. W. Kennedy. Sci. Agriculture 29, 185-8(1949).

Three sheep were fed urea containing approximately 30 at. % of N^{15}; after 4 days the animals were slaughtered, and the protein N was separated from the nonprotein nitrogen in the liver, kidneys and blood plasma. The concentration of N^{15} in the protein nitrogen of these fractions was greater than that present in animals receiving normal urea. Evidently the nitrogen of urea was incorporated into body proteins.

3906 On the Origin of Bile Pigment in Normal Man. Irving M. London, Randolph West, David Shemin, and D. Rittenberg. J. Biol. Chem. 184, 351-8(1950) May.

Glycine labeled with N^{15} was fed hourly in 1-g doses to a normal human subject for 48 hr and intravenously in 20-ml doses to another normal subject at the beginning of the experiment and at 5, 19, 24, 29, and 43 hr; 40-ml injections were given at 10 and 34 hr to the second subject. Hemin was isolated from blood samples taken at frequent intervals; stercobilin was isolated from the stools. The results of the experiments indicated that although the major portion of bile pigment in the normal man is derived from the hemoglobin of mature, circulating erythrocytes, a significant portion (at least 11%) is derived from one or more additional sources. The possible nature of the additional sources is discussed. 17 references. (auth)

3907 Porphyrin Formation and Hemoglobin Metabolism in Congenital Porphyria. Irving M. London, Randolph West, David Shemin, and D. Rittenberg. J. Biol. Chem. 184, 365-71(1950) May.

A 15-year-old girl who manifested symptoms of congenital porphyria was given glycine labeled with N^{15} in doses of 4.0 g every 3 hr during the day for a total of 5 doses per day; 60 g of glycine was administered over the course of 3 days. Uroporphyrin I was isolated from 4-day samples of urine, and coproporphyrin I and stercobilin were isolated from 4-day stool collections; hemin was prepared from 20- to 30-ml blood samples, and N^{15} analyses were carried out in the mass spectrometer. It was found that glycine is specifically utilized in the biological synthesis of porphyrins related to the etioporphyrin I configuration. The rates of degradation of uroporphyrin I and coproporphyrin I were rapid in this porphyric subject; the normal average erythrocyte life span of about 120 days was observed in this subject. A large part of the stercobilin was derived from sources other than the hemoglobin of mature circulating erythrocytes; the possible sources are discussed.

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3908 Phospholipin Metabolism in Rabbit-liver Cytoplasm. G. L. Ada. Biochem. J. 45, 422-8(1949).

A modification of the method of Hogeboom for the fractionation of liver cytoplasm by differential centrifugation was used for the preparation of three fractions, large granules, small granules (microsomes), and supernatant, from rabbit-liver cytoplasm; the method of Mirsky and Pollister was used to prepare rabbit-liver nuclei. The microsome and large granule fractions from 12 rabbit livers were analyzed for total lipid, phospholipid, protein, and nucleic acid content; the large granules contained 29.6% and the microsomes 43.4% total lipid content. The metabolism of the phospholipid phosphorus of the cytoplasmic fractions and the nucleus was studied with the aid of radioactive phosphorus (P^{32}); it was shown that at any time after the injection of radioactive phosphate into rabbits there exists in the liver cytoplasm at least three phospholipid fractions with different specific activities. The original observation of Hevesy, that the rate of renewal of phospholipid phosphorus in the liver nuclei is slower than in the cytoplasm, has been confirmed. The results suggest that phospholipids are being synthesized separately and metabolized independently of each other in different morphological structures of the liver cell.

3909 Proceedings of Washington University Medical Society. Wash. Univ. Med. Alumni Quart. 12, 116-23 (1949) July.

Among the papers presented were: Antigen tracer studies and histologic observations in anaphylactic shock in the guinea pig, Frank J. Dixon, Jr, and the use of radioactive iodine in thyroid disease, William H. Daughaday. The first paper is a discussion of the demonstration of a concentration of antigen in the bronchial walls during anaphylactic shock by a technique utilizing protein antigens labeled with I^{131}. The second paper is a presentation of 125 patients with hyperthyroidism and 11 patients with metastatic carcinoma of the thyroid who were treated with radioactive iodine.

3910 The Quantitative Significance of the Lymphatic Pathway in Transport of Absorbed Fatty Acids. B. Bloom, I. L. Chaikoff, W. O. Reinhardt, C. Entenman, and W. G. Dauben. J. Biol. Chem. 184, 1-8(1950) May.

A study on the transport of absorbed C^{14}-labeled palmitic acid via thoracic duct and intestinal lymph of unanesthetized male rats of the Long-Evans strains is presented. The rats received palmitic acid-1-C^{14} either in the form of tripalmitin or as the free fatty acid. In 19 to 24 hr, 12 of the 14 rats studied absorbed from 81 to 95% of the administered fatty acid-C^{14}. A total of 70 to 92% of the absorbed palmitic acid-C^{14} was recovered as fatty acid-C^{14} from thoracic duct lymph in 9 of the 10 rats studied. From 69 to 84% of the absorbed palmitic acid-C^{14} was recovered as fatty acid-C^{14} from intestinal lymph of 4 rats. The question of transport of absorbed fatty acids by routes other than the lymph stream is discussed. 14 references. (auth)

3911 Radio-Autographic Visualization of Bone Formation in the Rat. C. P. Leblond, G. W. Wilkinson, L. F. Bélanger, and J. Robichon. Am. J. Anat. 86, 289-327 (1950) Mar.

The localization of newly deposited bone phosphate was examined in radioautographs of tibia and humerus from newborn, 50-g, and adult rats at various time intervals after an injection of radiophosphorus, P^{32}. The results were supplemented by specific activity determinations of the phosphorus in bone parts. The circulating phosphate appeared to enter the skeleton either by exchange (a process of little significance in bone growth) or by precipitation in definite areas with the formation of new bone. While the exchangeable or "labile" phosphate showed in the autographs as diffuse reactions disappearing rapidly with time, the precipitated or "stable" phosphates showed as localized, persistant reactions, which could be used to trace the fate of new bone. The diaphysis of tibia and humerus revealed a triple origin: periosteal in its midportion, endosteal nearer to the epiphyseal plates, and endochondral immediately below the epiphyseal plates. The complex transformations involved satisfactorily accounted for the elongation of the bone without changes in its general shape. Although these transformations were obscured in the newborn rat by the abundance of labile phosphate, they were clearly visible in the growing young (50-g) rat and could be recognized in the adult where they proceeded at a slower rate. 33 references. (auth)

3912 The Rate of Interaction of the Amino Acids of the Diet with the Tissue Proteins. David B. Sprinson and D. Rittenberg. J. Biol. Chem. 180, 715-26(1949) Sept.

The rate of interaction of glycine with the body proteins was measured in rats and humans on high- and low-protein diets; glycine synthesized from isotopic ammonia and containing 32.9 at. % excess N was given to the human subjects by mouth in a single dose at a level of 10 mg/kg of body weight and to rats by stomach tube at a level of 80 to 170 mg/kg. Urine specimens were collected at various intervals and analyzed for total nitrogen and N^{15}. The rates of protein synthesis for the rat and the human were 1.0 and 0.20 g of nitrogen per day per kilogram of body weight, respectively. From the approximately known turnover times of the different organs and the synthetic rates for the whole organism, the authors state that only a fraction of the muscle proteins appears to be extensively involved in the dynamic state. 13 references. (auth)

3913 In Search of a Phospholipin Precursor. G. Popják and Helen Muir. Biochem. J. 46, 103-13(1950) Jan.

In order to determine whether the immediate P precursor of the phospholipids could be identified among the acid-soluble P fractions of the liver, albino rats in groups of four to six were injected subcutaneously with $Na_2HP^{32}O_4$ (10 μc dose per rat); the members of each group were killed at different intervals (45 min to 24 hr) after the injection. The rats were deeply anesthetized, and the liver was cut out, frozen, ground, and extracted for phospholipids by the procedure described. From the results it is concluded that the specific activity-time curve of the ethanol-precipitable phosphorus, obtained from the acid-soluble phosphate of liver, fulfills the criteria from this fraction, it being the phosphorus precursor of lecithin and cephalin; the acid-soluble fraction was found to contain α- and β-glycerophosphate. Lecithin and cephalin labeled with P^{32} were injected into rabbits; the glycerophosphate from the placenta and the

liver was found to contain the highest specific activity after the phospholipids. The authors conclude that this indicates that glycerophosphate is the P precursor of phospholipids and that the reaction is reversible. Negative results were obtained in experiments with P^{32}-labeled glycerophosphate. The turnover time of the phospholipids in the rat liver was calculated to be 6.75 hr. 20 references. (auth)

3914 Stercobilin Formation in a Case of Congenital Porphyria and in the Normal. C. H. Gray, A. Neuberger, and P. H. A. Sneath. Biochem. J. 45, xvi-xvii(1949).

An expansion of previous investigations by the authors with glycine labeled with N^{15} is presented; a control experiment was performed on a normal male and compared with results obtained with a porphyric person. The N^{15} content of the hemin in the porphyric person rises to a much greater value than in the normal; the maximum is followed by a sharp drop; the later part of the curve appears to be normal, indicating that the majority of the red cells have a life span of about 120 days. In the normal person the stercobilin contains a fairly high concentration of N^{15}. The results obtained suggest to the authors that in the porphyric person, a certain proportion of the red blood cells must have an exceedingly short life span. Other results of the investigation are included.

3915 Studies on the Rapidity of Complete Blood Circulation in Man. George C. Sutton, Johan Karnell, and Gustav Nylin. Am. Heart J. 39, 741-8(1950) May.

Two cardiac catheters were inserted into the right side of the heart of a human subject via an arm vein; the tip of one was placed in the pulmonary artery, while the tip of the other was kept in the right ventricle; the patient's own blood which had been tagged with P^{32} was introduced into the catheter ending in the pulmonary artery. After an interval blood samples were taken through the ventricular catheter to determine the basal level of the systemic P^{32} concentration. The samples were also analyzed for oxygen content, and the cardiac output was calculated by the Fick method (the individual's oxygen consumption having been determined before the investigation), the hematocrit and specific activity of the blood having been determined. The results indicated that detectable complete circulation occurred by the seventh to the ninth second. The authors conclude that calculations of cardiac output by this dilution method must be made from arterial time-concentration curves in which the characteristics of the descending limb can be calculated prior to the eighth or ninth second after the first appearance of the injected substance. 16 references.

3916 Study of Fertiliser Uptake Using Radio-Phosphorus. J. W. T. Spinks and G. Dion. J. Chem. Soc. (London) 1949, Suppl. No. 2, 410-15. (See also NSA 4-3657.)

Experiments have been carried out, both in the field and in the greenhouse, in which the uptake of phosphorus by wheat was followed by means of P^{32}. A variety of soils, fertilizers, and rates of application were studied, and the results were illustrated by charts.

3917 Study of Fertilizer Uptake with Radioactive Phosphorus. IV. The Availability of Phosphate Carriers in Calcareous Soils. H. G. Dion, J. E. Dehm, and

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J. W. T. Spinks. Sci. Agr. 29, 512-26(1949). (See also NSA 4-3657.)

On wheat under semiarid conditions on soil containing a high level of Ca, the P carriers used rated in the following order of effectiveness: monoammonium phosphate, monosodium phosphate, monocalcium phosphate, dicalcium phosphate plus calcium nitrate, and dicalcium phosphate. The total P taken up by the plant showed a good correlation with the amount of growth, and there was evidence that the younger plants had a relatively higher P content than older plants. The effect on plant growth of radiation and of radioactive P^{32} taken into the plant was negligible; there was no evidence of injury from tracer P^{32} when used in the field in reasonable amounts. Other conclusions are given.

3918 The Turnover of Radioactive Phosphate Injected into the Subarachnoid Space of the Brain of the Rat. O. Lindberg and L. Ernster. Biochem. J. 46, 43-7 (1950) Jan.

White rats were injected through the sutura sagittalis into the subarachnoid space with about 0.1 ml of a solution containing about 0.1 mc of P^{32} and a negligible amount of phosphate for the purpose of studying the rate of turnover of phosphate in the brain. Usually no change in the condition of the animals followed the injections; the animals were sacrificed, and the brains were removed, ground, and extracted with saturated ammonium sulfate; the radioactivity was then determined. It was found that the P^{32} injected intracranially was metabolized very rapidly in the rat brain; 2 min after injection, 40% of the newly introduced phosphate was found in organic linkage; after 8 hr, 80% was organically bound. Most of the organically bound phosphate was present in the form of adenosinetriphosphate and creatine phosphate; the labile phosphate groups were renewed at the rate of about 40 μg P/min/g of brain. This value is compared with those obtained elsewhere for liver and muscle. 18 references.

CHEMISTRY

3919 The Isolation of Morin as a Reagent for Beryllium Analysis. John F. Bonner, Jr. UR-111, Apr. 6, 1950. 9p.

Morin (3,5,7,2',4' pentahydroxyflavone) has been recommended as an extremely sensitive reagent for the detection and quantitative estimation of beryllium. In addition to the fluorescent determination of Be, morin is, or may be, of value in the analysis of Al, Th, U, F, and Ca. Development of these methods to a greater order of sensitivity and dependability requires a reagent of a higher degree of purity than is currently available. An alcohol or acetone extract of the technical material is highly colored, whereas pure morin is either colorless or only slightly colored. In a fluorometric determination, substances other than the sensitive complex may absorb either or both the exciting and emitted radiation, compete with the reagent for the substance to be measured, or contribute to the fluorescence of the blank. A procedure for the preparation of pure crystalline morin has been developed, using Eastman Kodak Co. technical grade morin. This procedure involves extraction with ethyl alcohol, precipitation from dilute acetic acid, extraction with ether, precipitation of the potassium salt in alcohol solution, and sublimation under vacuum.

CHEMISTRY

3920 Chromatographic Analysis (Report on a Conference at the University of Reading, September 22-24, 1949). D. H. Moore. Office of Naval Research (London Branch) Report No. OANAR-29-49, Nov. 9, 1949. 10p.

A general discussion on chromatographic analysis, sponsored by the Faraday Society, is reported. This report consists in a listing of the titles of the papers given, with summaries of most of them. The papers were divided into two sections: (I) Physicochemical Principles and their Utilization and (II) Applications: (a) Inorganic, (b) Organic and Biochemical.

3921 The Determination of Strontium in Sea Water—A Combination of Flame Photometry and Radiochemistry. A. A. Smales. Atomic Energy Research Establishment Report No. AERE-C/R-472, Jan. 1950. 16p.

After addition of a known quantity of strontium chloride (containing Sr^{89}) to the sea water, the part of the total strontium coprecipitated when barium chloride is added is measured by the decrease in activity of the filtrate and by the amount of strontium which must be added to the filtrate in order to readjust the strontium emission, as measured by flame spectrophotometry, to that before precipitation. From a simple equation the original strontium content of the sea water is easily obtained. Some data are also presented on the effect of the other constituents of sea water on the strontium emission in a propane-oxygen flame. (auth)

3922 Neutron Spectroscopy for Chemical Analysis. III. Thermal Neutrons, Neutron Flux, Activations. T. I. Taylor and W. W. Havens, Jr. Nucleonics 6, 54-66 (1950) Apr. (See also NSA 4-1787.)

Analytical applications of thermal neutrons are reviewed. Methods of analysis involving transmission measurements, neutron-flux reduction by an absorber, and radioactivation by neutrons are described, and their usefulness is outlined. Three tables summarize the following information; (1) approximate cross section of the elements for thermal neutrons (0.026 ev), (2) sensitivity of the neutron spectroscopy as a function of the neutron source, and (3) thermal neutron activation cross sections and properties of the resultant radioisotopes. 24 references.

3923 A New Simple Method for Accurate Measurement of Urinary I^{131} After Tracer and Therapeutic Doses. A. Stone Freedberg, Alvin L. Ureles, Marvin Van Dilla, and Mary J. McManus. J. Clin. Endocrinol. 10, 437-46(1950) Apr.

A new method for the measurement of urinary I^{131} is described. Four Pt cathode Geiger-Mueller tubes are connected in a parallel electrical circuit and arranged in a horizontal plane about the source. In the experiments described, a circle diameter of 120 cm was used. The urinary I^{131} content is measured by determining the radiation from the entire 24-hr collection of urine placed in the center of this circle. The standard of reference is a 5- to 10-cc aliquot of the I^{131} stock solution, from which the patient's dose is taken, diluted to approximately 1,500 cc in a gallon jug. The per cent urinary excretion was determined by this method in 38 subjects and compared to a γ counting method (Marinelli beaker) re-

quiring dilution and measurement of urinary volume. The average difference between the two methods was 3.4%, standard deviation 1.8. The urine volumes varied from 430 to 3,730 cc. No relationship was found between urine volume and the per cent difference in urinary I^{131} content. The results obtained provide experimental confirmation of the theoretical considerations which indicated the virtual freedom from absorption and geometry of the Pt cathode Geiger-Mueller tube arranged in a circle and connected in a parallel electrical circuit. The adaptation of this method, utilizing Cu screen cathode Geiger-Mueller tubes, for measurement of urinary excretion following therapeutic doses is described. The advantages and limitations have been indicated. The minimum handling of the urine sample and limited exposure to radiation have been noted. 16 references. (auth)

3924 Geometrical Factors Affecting the Contours of X-Ray Spectrometer Maxima. II. Factors Causing Broadening. Leroy Alexander. J. Applied Phys. 21, 126-36(1950) Feb. (See also NSA 2-324.)

By applying Stokes' Fourier transform method for the analysis of diffraction maxima produced by powdered samples consisting of small crystals (crystallites), it is shown that the pure diffraction contour generated by a crystallite size distribution is apt to be approximated rather closely by the function $1/(1 + k^2\phi^2)$. In the case of the x-ray spectrometer this pure diffraction contour is broadened significantly by the action of the following five geometrical factors: (I) the x-ray source width, (II) flat rather than curved sample surface, (III) vertical divergence of the x-ray beam, (IV) penetration of the sample by the beam, and (V) the receiving-slit width. The broadening of the pure diffraction contour due to the action of each of the five factors and the breadth of the final contour generated by the instrument can be deduced by employing the convolution approach suggested by Spencer. The effect of each instrumental factor is expressed by a convolution equation of the form,

$$f_i(\phi) = \int_{-\infty}^{+\infty} W_i(\zeta) f_{i-1}(\phi - \zeta) d\zeta ,$$

in which ϕ is the angular displacement from twice the ideal Bragg angle, 2θ, f_{i-1} is the contour before the action of the i'th geometrical factor, W_i is the form of the i'th geometrical factor, and f_i is the contour after the action of W_i on f_{i-1}. Starting with a pure diffraction contour of the form $1/(1+k^2\phi^2)$, generalized broadening curves are derived for the effect of each of the five geometrical factors. Using these curves it is possible to predict the breadth of the final diffraction contour generated by the spectrometer from an initial contour of any breadth. (auth)

3925 Effect of Deuteration, Oxidation, and Hydrogen-Bonding on the Infrared Spectrum of Cellulose. John W. Rowen and Earle K. Plyler. J. Research Natl. Bur. Standards 44, 313-20(1950) Mar.

Regenerated cellulose films were immersed in heavy water (99.58% D_2O) at temperatures up to 52°C for as long as 100 hr in an attempt to effect a substitution of D for the H in the OH groups of the cellulose. The intensity of the OH vibration in the 3-μ region of the spectrum of the films decreased very little. A weak OD vibration appeared in the

4-μ region. The results indicate that only a small fraction of the OH groups of the cellulose participated in an exchange under the conditions of the experiments. (auth)

3926 The Effect of Structural Factors on Conjugation Phenomena. I. The Mobility of Hydrogen Atoms in Cyclic Ketones of Various Structure. A. N. Nesmeyanov, D. N. Kursanov, K. A. Pecherskaya, and Z. N. Parnes. Izvestiya Akad. Nauk S.S.S.R., Otd. Khim. Nauk, No. 6, 592-7(1948)(in Russian).

Heavy water was used for the substitution of D for H in the α position in cyclic ketones. Such substitutions are correlated with the general mobility of the H atom in the sequence $-CH-CO-$ that must be regarded as a system of conjugated bonds H−C−C=O, analogous to the known C=C−C=O. Thus, in cyclohexanone all four α hydrogens, and in 2:2:6-trimethylcyclohexanone the unique α hydrogen, are replaced, whereas in the bicyclic camphenilone the reaction is forbidden on account of the presence, in the α position, of the foot of the $-CH_2-$ bridge. In the procedure adopted the substance investigated was heated (for 50 to 70 hr and in the presence of K_2CO_3) with water containing a known quantity of D_2O. The reaction product, separated from water, was analyzed by charring, and the formed water was tested for D content by the specific gravity method. In this way the number of H atoms replaced was determined, and the result was checked by the D defect in water separated from the reaction product.

3927 Low Temperature Thermal Data on Hexadecafluoroheptane and Chlorotrifluoroethylene. G. D. Oliver, J. W. Grisard, and V. E. Anderson. K-593, Apr. 20, 1950. 13p.

The heat capacity of hexadecafluoroheptane was measured over the temperature range of 18 to 300°K. A transition found at 180.46°K was determined as absorbed 1,594 cal/mole. The heat of fusion value of 1,660 cal/mole was determined at the triple point, 221.86 ± 0.05°K of the pure material. The total entropy of the liquid at 298.16°K had a value of 134.24 ± 0.27 cal/deg mole. Heat-capacity measurements were made on chlorotrifluoroethylene from 16 to 244.80°K, the boiling point. The value of the heat of fusion at the triple point of 115.00 ± 0.05°K was 1,327 cal/mole. Entropy values of the liquid and the ideal gas at 244.80°K were 52.73 ± 0.10 and 75.17 ± 0.20 cal/deg mole, respectively. (auth)

3928 Bromination of Trifluoromethylbenzenes. E. T. McBee, R. A. Sanford, and P. J. Graham. J. Am. Chem. Soc. 72, 1651-3(1950) Apr.

A procedure for the bromination of trifluoromethyl and bis-(trifluoromethyl) derivatives of benzene and chlorobenzene is described which comprises the simultaneous use of bromine and chlorine in the presence of the halogen carrier, antimony(V) chloride. Physical properties of the new compounds are reported. (auth)

3929 Fluorocarbon Chemistry. III. Hydrogenolysis of C−C Bonds of Fluorocarbons. W. R. James, W. H. Pearlson, and J. H. Simons. J. Am. Chem. Soc. 72, 1761-4 (1950) Apr.

Reactions of fluorocarbons with hydrogen at elevated temperatures have been studied. The principal products are those to be expected from the cleavage of C−C bonds in the

presence of hydrogen, CF_3H, and similar hydrofluorocarbons. The comparative stability of the cyclic fluorocarbons is demonstrated by their resistance to hydrogenolysis of the ring structure. (auth)

3930 A New Method of Preparation of Esters of Difluoroacetic Acid. John A. Young and Paul Tarrant. J. Am. Chem. Soc. 72, 1860-1(1950) Apr.

It has been found that esters of difluoroacetic acid, from which other derivatives may be readily prepared, can be obtained in good yields by a simple two-step process, using a commercially available fluorine compound as the starting material. This method consists in the preparation of 1-ethoxy-1,1,2,2-tetrafluoroethane by the reaction of sodium ethoxide on 1-chloro-1,1,2,2-tetrafluoroethane (Freon 124A) followed by the hydrolysis of the ether to ethyl difluoroacetate with concentrated sulfuric acid.

3931 On the Molecular Configuration of Cyclic C_4F_8. Walter F. Edgell and Donovan G. Weiblen. J. Chem. Phys. 18, 571(1950) Apr (Letter to the editor).

The Raman spectrum of C_4F_8 was studied and found to be in disagreement with the planar ring structure of symmetry D_{4h}.

3932 Improved Chemistry Cave. Roland A. Blomgren and French Hagemann. ANL-4426, Mar. 1, 1950. 12p.

An improved chemistry cave has been constructed. The design of the structure incorporates the following features: (1) γ-radiation protection equivalent to 4 in. of lead from floor to above head levels, (2) direct visibility throughout working area from operating side of cave, (3) ready accessibility for setup and repair by the operator, (4) accessibility to all areas by a manipulator, (5) partial accessibility by an outside crane, (6) ample utility sources with connections and controls located outside the cave, (7) easily decontaminable, and (8) uniform air flow through the cave volume.

3933 Mechanism of the γ-Ray Induced Oxidation of Formic Acid in Aqueous Solution. Edwin J. Hart. ANL-4434, Apr. 4, 1950. 20p.

The mechanism of formic acid oxidation by γ rays from a 25-c Co^{60} source has been studied in air-free aqueous solutions at pH 2.7 to 3.0. Oxidation of the formic acid occurs as a result of its reaction with the H^+ and OH^- free radicals produced by primary ionization of the water by the γ rays. In order to differentiate between the effects of the H^+ and OH^- radicals, the kinetics of formic acid oxidation were studied in the presence of hydrogen peroxide. At 0.01M formic acid the hydrogen peroxide concentration was varied from 1.5×10^{-5} to 0.02 mole/liter, and at 0.001M hydrogen peroxide the formic acid concentration was varied from 2×10^{-4} to 0.02 mole/liter. It was found that throughout these ranges of concentrations the reaction followed the equation: $HCOOH + H_2O_2 = 2H_2O + CO_2$. Oxygen is not liberated, and only relatively small amounts of hydrogen are produced in this hydrogen peroxide–formic acid reaction. In the absence of hydrogen peroxide, the net over-all reaction at a pH of 3.0 is: $HCOOH = H_2 + CO_2$. The rate of oxidation of formic acid increases at first with increasing hydrogen peroxide concentration. A maximum increase in rate of 55-fold exists near 0.00074M hydrogen peroxide, and thereafter the rate of oxidation decreases with increasing hydrogen

peroxide concentration. At 1.7×10^{-5}M hydrogen peroxide the increase in rate is about tenfold. A striking oxygen inhibition of the hydrogen peroxide–catalyzed oxidation of formic acid was also found. Additional hydrogen peroxide is formed from the oxygen added; after the oxygen has been consumed, the normal rate of the hydrogen peroxide–formic acid reaction is restored. At low concentrations of oxygen the induction period is a linear function of oxygen added. The hydrogen peroxide–formic acid reaction is discussed in terms of the following series of reactions:

(1) $H_2O + \gamma \text{ rays} = H^+ + OH^-$
(2) $H^+ + HCOOH = H_2 + HCOO.$
(3) $OH^- + HCOOH = H_2O + CO_2$
(4) $OH^- + HCOO. = H_2O + CO_2$
(5) $HCOO. + H_2O_2 = H_2O + CO_2 + OH^-$
(6) $HCOO. + X = CO_2 + HX$
(7) $OH^- + H_2O_2 = \text{termination products}$

Formic acid oxidation is believed to follow the course (1), (2), (4), (6) in the absence of hydrogen peroxide. The oxygen inhibition takes place through the reaction of oxygen with hydrogen since hydrogen peroxide produced is equivalent to the oxygen present. 12 references. (auth)

3934 Contamination in Orthophosphates Irradiated in a Neutron Pile. Maurice Fried and Arnold J. MacKenzie. Science 111, 492-3(1950) May 5.

Experiments are described which were performed in order to determine the degree and nature of contamination present in samples of $KH_2P^{32}O_4$ prepared by pile neutron irradiation of KH_2PO_4. Phosphorus was precipitated from an aliquot of the KH_2PO_4 in alkaline solution as magnesium ammonium phosphate; phosphites are not soluble under these conditions, although pyro and meta phosphates are. This and other experiments indicate that the contamination was in the form of a phosphite. The authors conclude that the implications from the results are twofold: any possible use of P^{32}, either in tracer work or therapeutically, should take into account the possible presence of a phosphite contaminant of high specific radioactivity; a possible method for elimination of contamination is suggested and would be valid only if the lower oxidation state of phosphorus were caused by the ejection of the phosphorus atom due to some specific nuclear reaction.

3935 Joint Meeting of the Newcastle Section of the Society of Chemical Industry and the Newcastle-upon-Tyne and Tees-side Sections of the Royal Institute of Chemistry, held at Durham City, Jan. 24, 1950. Chemistry & Industry, No. 9, 167(1950) Mar. 4.

The following paper was presented: Chemical Reactions Induced by Nuclear Radiations, F. S. Dainton. After adsorption of high-energy quanta, the primary reaction experienced in radiation chemistry is the loss of energy of a charged particle in inelastic collisions; such collisions may result in the ionization or excitation of the target molecule. The ions, and any unchanged species so formed, will be present in higher concentration near the end of the particle track; the concentration will depend on the mass of the incident particles. Some of the ions formed may be changed into related ions by charge transfer, breakdown, or by "ion–neutral molecule" reactions. For the decomposition of water by irradiation it can be shown that the entities found in the primary act which are likely to have the most far-reaching chemical

consequences are unchanged hydrogen atom and the hydroxyl radical. Experiments are in progress to determine the energy necessary to achieve dissociation of a molecule, the spatial distribution of the components, and other related problems.

3936 The Kinetics and Specificities of Deamination of Nitrogenous Compounds by X-radiation. W. M. Dale, J. V. Davies, and C. W. Gilbert. Biochem. J. 45, 93-9(1949).

Experiments are described, showing the deamination by x-rays of some amino acids and their derivatives, polypeptides, and related nitrogenous compounds; the relationship between the ionic yield and the radiation dose has been studied in detail for glycine. The ionic yield rose from 0.3 to 2.9 for very dilute to nearly saturated solutions; the ionic yield for dry glycine was 2.96. An explanation of the high ionic yield with glycine is presented in terms of a hypothesis assuming either a chain reaction or the formation of radicals by excitation in addition to charge neutralization. The continuous rise of the ionic yield is interpreted as being caused by recombination of radicals competing with deamination even at the highest concentrations of glycine, due to a low affinity of glycine to radicals. The explanation offered, although consistent with the experiments described, is concluded to be somewhat unsatisfactory in view of the radiation effects on thiourea. The biological significance of the results is discussed. 24 references. (auth)

3937 Radiochemical Efficiency of Ultraviolet Emission in Gases Traversed by Alpha Particles. Solange Lormeau. Compt. rend. 230, 956-7(1950) Mar. 6 (in French).

The passage of α particles through gases induces ultraviolet emission caused by the decay of excited atomic states. The author has determined the radiochemical efficiency of this process for air. More precisely, she has determined the ratio between the number of photons emitted under the influence of a polonium source and the number of ion pairs formed. The experimental arrangement is described in detail. It is concluded that the efficiency of this process lies between 10^{-7} and 2×10^{-7}.

3938 The Purification of Lutecium by Fractionation of Hexa-Antipyrinelutecium Iodine. Joseph K. Marsh. J. Chem. Soc., 577-8(1950) Feb.

It is demonstrated that fractionation of hexa-antipyrinelutecium iodine, $[Lu(C_{11}H_{12}N_2O)_6]I_3$, gives a very rapid purification. This is ascribed to a large complexing, rather than a solubility, differential. The separations of thulium and erbium and of holmium and dysprosium have also been noted. (auth)

3939 Quantitative Roentgen-Spectrum Analysis of Rare-Earth Elements by the Method of "Inner Coefficients." E. E. Vaĭnshteĭn and N. V. Turanskaya. Zhur. Analiticheskoĭ Khim. 4, 323-31(1949)(in Russian).

Given a mixture containing several rare-earth elements A, B, etc., the authors apply the name "inner coefficient of A and B" to the function $k = (x/y)/(s_A/s_B)$, where x and y are the concentrations of A and B, and s_A and s_B are the degrees of the darkening produced on a photographic plate by two close lines, Lβ and Lα, of the mixture's x-ray spectrum, Lβ belonging to A, and Lα to B. The authors found that, for any pair of rare earths so far examined, k is independent of the presence of other elements in the mixture, so that from empirically constructed curves for k of various pairs and the measured ratios of darkenings, the relative contents of various components in a mixture can be determined. If, further, a known quantity b of B is added to a mixture of A and B, the equation $k_1 = [x/(y + b)]/(s_A/s_B)_1$ is obtained, which, together with the original $k = (x/y)/(s_A/s_B)$, permits the determination of the absolute values of x and y. It is seen that only one such addition is necessary for the complete analysis in a case of many components. The method was tested on Ce, Nd, Pr, La, and Ba; the error did not exceed 4%.

3940 The Use of Ion Exchangers for the Determination of Physical-Chemical Properties of Substances, Particularly Radiotracers, in Solution. III. The Radiocolloids of Zirconium and Columbium. Jack Schubert and John W. Richter. AECD-2813, nd, Decl. Mar. 28, 1950. 18p.

The marked differences between cation-exchange adsorption and radiocolloidal adsorption by a synthetic cation exchanger have been shown experimentally. The tracer elements studied were Zr^{95} and Cb^{95} in salt solutions of alkaline-earth nitrates. The composition of the alkaline-earth nitrate solutions was varied by addition of nitric, sulfuric, phosphoric, fluosilicic, and oxalic acids. From the data the relative strengths of some of the complex ions of Zr and Cb were deduced. The applications of radiocolloidal adsorption phenomena for the separation and purification of elements by an ion exchanger were discussed. 20 references. (auth)

3941 The Fractional Separation of Zirconium and Hafnium by Extraction with Trifluoroacetylacetone. Edwin M. Larsen and Boyd G. Schultz. University of Wisconsin, Jan. 31, 1950. 12p. (AEC File No. NP-1397.)

Zirconium and hafnium were successfully separated by extracting a 0.2N hydrochloric acid solution of the ions with a benzene solution of trifluoroacetylacetone. The zirconium was preferentially extracted into the benzene phase as the chelate compound, tetrabis (1,1,1 trifluoro-2,4 pentanedione) zirconium in a manner similar to that observed in the extraction of a zirconium–hafnium perchlorate solution, with thenoyltrifluoroacetone (Huffman and Beaufait, J. Am. Chem. Soc., 71, 3179(1949)). In two extractions the mole % of hafnium in a zirconium–hafnium mixture was reduced from 1.56 to less than 0.1 to 0.05 with a 6.9% yield of the original zirconium, and in six extractions the mole % of hafnium in a zirconium–hafnium mixture was increased from 7.5 to 99.98 mole % with a 37.6% yield of the original hafnium. A study of the variables involved in the extraction process showed that the diketone concentration, acid concentration, total metal ion concentration, and ion species were all factors to be considered. The extraction coefficients appeared to follow a fourth-power dependence on the diketone activity at constant hydrochloric acid concentration and constant initial metal ion concentrations. However, equilibrium constants calculated on the basis of monomeric ion species showed a decrease with increasing metal ion concentration. This observation

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was shown to be consistent with the ideal that the zirconium and hafnium ions exist in equilibrium with nonextractable polymeric species even at moderate concentrations. With increasing chloride ion concentration, a change in K values indicated chloride–metal ion complexing was prominent and that the hafnium–chloride complex was stronger than the corresponding zirconium ion pair. 11 references. (auth)

3942 New Experiments on the Cathodic Deposition of Radio-elements. M. Haissinsky and A. Coche. J. Chem. Soc. (London) 1949, Suppl. No. 2, 397-400.

Deposition potentials for polonium, lead, and bismuth on various cathodes in extremely dilute solution have been investigated and found to be abnormal in several instances, since they do not conform to the Nernst equation. The normal potential of polonium is discussed, and the value $E_h^0 = +0.77$ v is believed to be nearly correct. (auth)

3943 Absorption Spectra of Vanadium(III) and Vanadium(IV) Ions in Complexing and Non-Complexing Media. Sydney C. Furman and Clifford S. Garner. J. Am. Chem. Soc. 72, 1785-9(1950) Apr.

The absorption spectra of aqueous vanadium(III) perchlorate solutions have been determined and analyzed into the absorption curves for the free (hydrated) V^{+3} ion and its hydrolysis product (hydrated) VOH^{+2}. The heat of the hydrolysis of V^{+3} to form VOH^{+2} has been found to be $\Delta H_1 = 10 \pm 1$ kcal/mol at room temperature from measurements made at different temperatures with solutions having an ionic strength of 1.0. ΔF_1 and ΔS_1 have been calculated from an approximate value of the hydrolysis equilibrium constant to be 4 kcal/mol and 20 cal/deg/mol, respectively. The spectra of aqueous vanadium(III) chloride solutions indicate complex ion formation. The absorption spectra of aqueous vanadium(IV) perchlorate solutions have been determined. (auth)

3944 An Easy Route to Methylene-Labeled Glycine. G. Ehrensvärd and R. Stjernholm. Acta Chem. Scand. 3, 971-4(1949).

$HOOC\text{-}C^{13}H_2\text{-}NH_2$ (I) is obtained in an over-all yield of 50% or more as follows: N,N′-diphenylthiourea is condensed with $KC^{13}N$ in the presence of basic $PbCO_3$ in water-alcohol mixture to N·N′-diphenyl-cyanoformamidine (II). (II) is reduced with $LiAlH_4$ to glycine-N,N′-diphenyl-amidine which is subsequently hydrolyzed into (I) by boiling for 1 hr with $Ba(OH)_2$ in water solution.

3945 The Nutritive Value of Nitrogenous Compounds for Ruminants. III. Synthesis of Urea Containing N^{15}. L. C. Leitch and W. M. Davidson. Sci. Agr. 29, 189-90(1949).

A method for the preparation of urea containing N^{15} is described by the author. Diphenyl carbonate is prepared from phosgene and phenol. This compound then reacts with ammonia containing N^{15} to form urea.

3946 Preparation of Radioactive SO_2 from $BaSO_4$. Rowland E. Johnson and J. L. Huston. J. Am. Chem. Soc. 72, 1841-2(1950) Apr.

The combustion in oxygen of an intimate mixture of $BaSO_4$ and red phosphorus provides a simple and direct method for obtaining a good yield of radioactive SO_2 from $BaSO_4$. The apparatus and procedure are described.

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3947 Applications of Tracer Atoms in the Study of the Phenomena of Adsorption and Catalysis. N. P. Keĭer. Uspekhi Khim. 19, 59-87(1950)(in Russian).

A survey of papers on adsorption and catalysis shows the very important part the radioactive-isotope method plays in these investigations. In the field of adsorption phenomena, much work has been done by Russian radiochemists. Khlopin and his collaborators studied the mechanism of the adsorption of microcomponents from mixtures, and the role played in those processes by the isomorphism (Z. anorg. u. allgem. Chem. 143, 97(1925); ibid. 166, 311(1927); Ratner et al, Z. physik. Chem. 165A, 472(1933); Acta Physicochim. U. R. S. S. 11, 475(1939)). Methods for the determination of absolute values of the surface areas of crystalline suspensions were improved by Khlopin et al (Zhur. Fiz. Khim. 13, 1145(1939)), while the peculiarities in the behavior of adsorption isotherms were investigated by Frumkin et al (Bull. acad. sci. U. R. S. S., Classe sci. chim., 773(1936)), Kobozev et al (Zhur. Fiz. Khim. 15, 257(1941)), Vol'kenshtein (ibid. 21, 163(1947)), and Roginskiĭ (Adsorption and Catalysis on Heterogeneous Surfaces, published by Academy of Sciences U. S. S. R., 1948 (in Russian)). The latter works are more or less directly connected with the problem of the heterogeneity of the surface of the adsorbent, which was also studied by Nikitin et al (Bull. acad. sci. U. R. S. S., Classe sci. chim., 210(1944)), Roginskiĭ (Acta Physicochim. U. R. S. S. 21, 519(1946)), and Keĭer et al (Zhur. Fiz. Khim. 23, 897(1949)). In the section describing the use of radioactive isotopes in the study of the catalysis, the majority of the works mentioned are American and British. Among the Russian investigators, Roginskiĭ and his collaborators (see above) studied the influence of small admixtures on the activity of a catalyst and the mechanism of the isotopic exchange (Bull. acad. sci. U. R. S. S., Classe sci. chim. 5, 601(1940)).

3948 The Effect on Reaction Rates Caused by the Substitution of C^{14} for C^{12}. William H. Stevens and Richard W. Attree. J. Chem. Phys. 18, 574(1950) Apr. (Letter to the editor). (See also NSA 4-120.)

This is a preliminary report on the results of experiments involving the Cannizzaro reaction, the benzoin condensation, and the benzilic acid rearrangement, which were undertaken to investigate the effect on reaction rates caused by the substitution of C^{14} for C^{12}. It has been found that any difference in the rate constants for the C^{14} labeled and unlabeled molecules is less than the probable counting error (±1.5%) in both the Cannizzaro reaction and the benzoin condensation. A benzilic acid rearrangement reaction resulted in a ratio 1.11 ± 0.01 of the amount of benzilic acid-2-C^{14} to benzilic acid-1-C^{14}.

3949 Identification of Free Radicals by Radio-halogens in the Radiolysis of Hydrocarbons. Russell R. Williams, Jr., and William H. Hamill. J. Am. Chem. Soc. 72, 1857-8(1950) Apr.

By using molecular halogens of high specific activity in systems where such radicals are generated, one may expect to be able to observe unweighable, but radiochemically detectable, amounts of the halides corresponding to the free radicals formed. Subsequent addition and fractionation of appropriate carrier substances, followed by activity determinations, will give an estimate of the types and relative

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amounts of radicals formed. This procedure has been tested in a number of systems, producing free radicals both by absorption of light and ionizing radiations.

3950 Isotopes in the Study of Chemical Reactions. H. R. V. Arnstein and Ronald Bentley. Nucleonics 6, No. 6, 11-27(1950) June.

A summary is made of the applications of deuterium, N^{15}, C^{11}, C^{13}, and C^{14} in the tracer study of chemical reaction mechanisms. The important reactions and exchanges in which each has been used are described.

3951 Meeting of the Birmingham and Midland Section of the Society of Chemical Industry, held at Birmingham, Jan. 25, 1950. Chemistry & Industry No. 14, 270(1950) Apr. 8.

The following paper was presented: The Application of Isotopes in Chemical Industry, Henry Seligman. The author states that the sensitivity of detection in radioisotopic procedures may be a million times better than in any spectrographic method; radioisotopic methods may be employed in corrosion tests, studies of the poisonous effects of fumigants on foodstuffs, or in experiments on the penetration of porous substances by organic compounds; a number of inspection and chemical control problems may be efficiently handled with radioisotopes. Other applications of radioisotopes are mentioned.

3952 On the Equivalence of Chemical Bonds in the Complex Ion $(HgBr_4)^{-2}$. Ya. A. Fialkov and Yu. P. Nazarenko. Doklady Akad. Nauk S.S.S.R. 69, 201-3(1949)(in Russian).

The equivalence of all 4 bonds Hg–Br in the ion $(HgBr_4)^{-2}$ of the crystalline $K_2(HgBr_4)$ was tested by investigating the systems $K_2(HgBr_4) + Br_2$ and $HgBr_2 + 2KBr$, in which Br_2 and KBr contained radioactive Br. This equivalence was proved by demonstrating the equal readiness of the 4 Br atoms to undergo isotopic exchanges, as seen in the equal activities of the products of a thermal disintegration of $K_2(HgBr_4)$ obtained in both experiments.

3953 Radioactive Halogens and the Mechanism of Replacement Reactions. E. D. Hughes. J. Chem. Soc. (London) 1949, Suppl. No. 2, 400-5.

Symmetrical exchanges of the form $\overline{X} + R\text{-}X \rightarrow X\text{-}R + \overline{X}$ are considered in the study of nucleophilic replacement reactions. For reactions with halide ions, the rates of exchange and of recemization of optically active organic halides are compared, and it is concluded that substitution by the bimolecular mechanism (S_N2) is accompanied by inversion of configuration. The application of the result of the general problem of the Walden inversion is considered. It is shown that the phenomenon of steric hindrance is associated with the bimolecular mechanism. The exchange rates for common organic halides are discussed in relation to a semiquantitative theoretical treatment of the effect. The existence of a one-stage bimolecular mechanism of rearrangement in anisotropic systems (S_N2') is demonstrated.

3954 Chemistry of the Transuranic Elements. M. W. Lister. Quart. Revs. 4, 20-44(1950).

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The chemistry of transuranic elements is outlined in a review containing 91 references, among which many are documents that have been published by the United States Atomic Energy Commission. The sections are the following: (1) Solution Chemistry; (2) Metals and Compounds: Metals, Oxides, Hydroxides, Peroxides, Salts, Hydrides, Nitrides, Carbides, Borohydrides; (3) Structure of the Atoms. In Sec. 3 the chemical and physical evidence is examined, which bears on the question of the filling of the 5f shell in the atoms of the transuranic elements.

3955 On the Complex Chemistry of the Uranyl Ion. III. The Complexity of Uranyl Thiocyanate An Extinctiometric Investigation. Sten Ahrland. Acta Chem. Scand. 3, 1067-76(1949). (See also NSA 3-2163 and 4-1421.)

The complexity of the uranyl thiocyanate system in aqueous solution is extinctiometrically investigated. The measurements are performed at 20°C and at the ionic strength I = 1, which is brought about by $NaClO_4$ and 100-milliequivalent $HClO_4$. The latter presses the hydrolysis of UO_2^{+2} back to a value which may be neglected. According to both the criteria applied, no polynuclear complexes seem to exist in this system. The first three complexes of the mononuclear series are proved. Their constants are at the existing conditions $\beta_1 = 5.7$, $\beta_2 = 5.5$, $\beta_3 = 15$. (auth)

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3956 Properties of a Boron Carbide–Iron Ceramal. W. G. Lidman and H. J. Hamjian. Lewis Flight Propulsion Laboratory Report No. NACA-TN-2050, Mar. 1950. 23p.

An investigation has been made to determine the properties of a boron carbide–iron ceramal. These properties were compared with the properties of hot-pressed boron carbide. The properties evaluated were room- and elevated-temperature moduli of rupture, resistance to fracture by thermal shock, density, and oxidation characteristics. A study was also made of the microstructure of the ceramal. Microscopic examination showed the ceramal to be composed of not less than 2 phases: boron carbide, and a solution or chemical combination of iron and boron carbide. Ceramals containing materials that form a bonding phase may possess desirable strength properties at temperatures approaching the melting point of the metal. The hot-pressed boron carbide was superior to the ceramal in modulus of rupture. A high percentage of the room-temperature strength was retained by the ceramal at 2600°F, which was attributed to the high strength of the carbide network, strengthening of the iron by combination with some of the boron carbide, or both. The thermal-shock resistance of boron carbide was improved by the addition of iron. At 1600°F the resistance to oxidation of the ceramal was better than that of the ceramic; although both materials oxidized rapidly at 2000°F, the ceramic was superior. The poor oxidation resistance of the ceramal indicated that a protective coating would be required for continued operation above 1600°F. The boron carbide–iron ceramal has a low density (average density 3.24 g/ml), which gives it an additional advantage when it is compared with

metals or other ceramals on the basis of the strength-density ratio. (auth)

3957 The Stability and Chemical Reactivity of Titanium Nitride and Titanium Carbide. F. H. Pollard and P. Woodward. Trans. Faraday Soc. 46, 190-9(1950) Mar.

TiN has been shown to undergo a second-order decomposition in a vacuum at temperatures of 1000°C and higher, and the reactions of both the nitride and the carbide with various gases have been studied at 1200°C. Rapid oxidation occurs in presence of O_2, NO, and CO_2, but N_2, H_2, and CO do not react. The reactions of TiC with N_2O and with CO_2 are both of first order. (auth)

3958 Significance of Radioactivity in Geophysics; Thermal History of the Earth. W. D. Urry. Trans. Geophys. Union 30, 171-80(1949) Apr.

It is concluded that the effects of the exponential decay of the atomic heat sources within the earth have led, in its early history, to a heating of the upper crust and afterward to a nearly linear cooling. In greater depths conditions were more complicated, with simultaneous heating and cooling of different layers. The determination of the radioactivity of ultrabasic rocks and Fe meteorites indicates that a monomineralic olivine mantle and an Fe core will have remained essentially at the initial temperatures. The bearing on the hypotheses of the origin of the earth is examined.

3959 The Application of Chemical Thermodynamics to the Study of Metallic Alloy Formation; Quarterly Progress Report for January 1, 1950, to April 1, 1950. W. E. Wallace, R. S. Craig, T. M. Buck, D. A. Edwards, E. E. Ketchen, C. B. Satterthwaite, and F. A. Trumbore. NYO-604, Mar. 31, 1950. 9p.

The work reported here is a continuation of previous studies (NYOO-100). Heat of formation studies have been made with Na-K alloys and with Mg-Cd alloys. A new high-temperature thermostat to accommodate a large emf cell in which five Mg-Cd alloys can be simultaneously studied has been designed and built for making free-energy studies. During specific-heat studies on the Mg-Cd system earlier temperature-scale calibrations were found to be in error, and a new scale, based on February 1950 experiments, has been constructed. Since specific-heat determinations will be made on alloys in lump form, a "core" to contain thermometer, heater, sample, support, etc., is necessary. A core of the proper characteristics has been designed and built, with particular emphasis on obtaining good thermal contact between core and sample. X-ray diffraction work has been initiated to ascertain the temperature-composition relationships for phase segregation and the development of ordered structures in Mg-Cd systems.

3960 Heats of Formation of Sodium Potassium Alloys. Raleigh L. McKisson and LeRoy A. Bromley. UCRL-671, Apr. 17, 1950. 10p.

Measurements of the heat of formation of sodium-potassium alloys have been carried out by mixing liquid metals and noting the temperature drop. The values found for the heats

of formation from the elements in their standard states are: (the elements are solid at 25°C and liquid at 110°C)

$$\begin{aligned} NaK\ (l)\ \Delta H_{25°C} &= +1430\ \Delta H_{110°C} = +360 \\ NaK_2\ (l)\ \Delta H_{25°C} &= +2130\ \Delta H_{110°C} = +530 \\ Na_2K\ (l)\ \Delta H_{25°C} &= +2140\ \Delta H_{110°C} = +530 \end{aligned}$$

All values are accurate to about 100 cal/mole. None of the values agree well with the results of previous workers. (auth)

3961 The Casting of Inconel-Tubing Heaters in High Copper Alloy. F. J. Lambert. Y-583, Mar. 9, 1950. 25p.

Because of the short average life of inconel-tube heaters embedded in high copper alloy castings, radiographic investigations were made to determine the cause of failure; this was found to be due to voids in the castings, especially around the inconel tubing. Experiments were carried out to find casting conditions and methods of surface preparation of the inconel tubing which would give sound castings. The results of these experiments are reported, and recommendations are given for tube-surface preparation and casting techniques which will give sound castings. (auth)

3962 A Compression Method for the Production of Objects of Complicated Shape from Metal Powders. Hermann Silbereisen. Z. Metallkunde 40, 66-7(1949)(in German).

A mass production of pieces of complicated shape from compressed and sintered metal powder has not been possible because, unlike liquid or viscous substances, a powdered mass will present the required uniform density only if the applied pressure has been adjusted to the various thicknesses of an intricate body. The author claims to have devised a machine permitting a rapid and automatic pressure adjustment, working in a rhythmic succession of phases. No illustrative sketches are given.

3963 Effect Produced on the Sintering Shrinkage by Traction Forces Applied During the Sintering. Walther Dawihl and Walter Rix. Z. Metallkunde 40, 115-17 (1949)(in German).

The volume shrinkage taking place during the sintering of metal powders can be modified by applying feeble traction forces to the piece during the sintering process. By using test bars prepared from Co powder, it was found that if a pulling force of only 25 g/mm^2 is applied, the shrinking in the longitudinal direction is completely hindered, while the simultaneous transverse shrinking is thereby increased. However, the two effects do not exactly counterbalance each other, so that the density of the final product depends on the force applied. (auth)

3964 Ternary Alloys of Titanium. C. M. Craighead, O. W. Simmons, and L. W. Eastwood. J. Metals 188, 514-38(1950) Mar.

The results of a preliminary study of 113 ternary titanium-base alloys are described. The compositions investigated are as follows: (1) ternary titanium-carbon alloys containing copper, silicon, vanadium, chromium, manganese, iron, or cobalt; (2) ternary titanium-nitrogen alloys containing chromium; (3) ternary titanium-chromium alloys containing ad-

ditions of vanadium, molybdenum, tungsten, cobalt, or nickel; (4) ternary titanium-manganese alloys containing additions of silicon, chromium, tungsten, or iron. Tensile properties, minimum bend radii, hardnesses, response to heat-treatment and aging treatment, and phase relationships for these alloys were determined. (auth)

3965 Titanium Binary Alloys. C. M. Craighead, O. W. Simmons, and L. W. Eastwood. J. Metals 188, 485-513(1950) Mar.

Binary alloys of titanium with silver, lead, tin, nickel, copper, beryllium, boron, silicon, chromium, molybdenum, manganese, vanadium, iron, and cobalt were studied. One-half-pound ingots of the alloys were prepared in an arc furnace, employing a water-cooled copper crucible, an argon atmosphere, and a water-cooled tungsten electrode. The ½-lb ingots were fabricated by forging at 1700°F in air to ¼-in. slab, followed by hot rolling at 1450°F to 0.060-in. sheet. Tensile properties, minimum bend radii, hardnesses, response to heat-treatment and aging treatment, and phase relationships were determined for these alloys. (auth)

3966 A New Surface Measurement Tool for Mineral Engineers. F. W. Bloecher, Jr. NYO-584(MITS-6) Apr. 15, 1950. 21p.

The design and operation of a surface-area measurement device based on low-temperature krypton adsorption measurements by the technique of Beebe (J. Am. Chem. Soc., 67, 1554(1945)) is described. The application of the apparatus to finely divided minerals is discussed. Data are included on some representative measurements. 17 references.

3967 Abundance of N^{15} in the Nitrogen Occluded in Radioactive Minerals. William C. White and Herman Yagoda. Science 111, 307-8(1950) Mar. 24.

In an investigation of the occluded gases in radioactive minerals by means of the mass spectrometer, the authors have detected nitrogen and helium in the fraction isolated by ignition of the samples and remaining uncondensed in a liquid-air trap. Samples of the freshly ground minerals were heated in quartz tubes and kept red hot for several hours. The liquid-air trap condensed water vapor and CO_2 out of the gases collected in the tube. The isotopic ratio of N^{15} to N^{14} in these gases was invariably higher than in samples of atmospheric air or in nitrogen isolated from nitrogenous compounds. Several types of uranium ores were analyzed, their geological ages were determined, and the percentage of N^{15} abundance seems to be roughly proportional to the age of the mineral. The authors suggest that the nitrogen was present at the time of formation of the mineral, and that the N^{15} abundance was augmented by the more rapid diffusion of the N^{14} isotope. However, none of the proposed hypotheses seem to adequately explain the phenomenon.

3968 Comparison of the Isotopic Constitution of Terrestrial and Meteoritic Sulfur. J. Macnamara and H. G. Thode. Phys. Rev. 78, 307-8(1950) May 1 (Letter to the editor).

Ten samples of troilite from four siderite and two stony meteorites have been analyzed with a 180-deg direction focusing mass spectrometer of the Nier type (Can. J. Research B23, 40(1945)). The S^{32}/S^{34} ratios obtained from these samples are tabulated. It is seen that the S^{32}/S^{34} ratios for meteoritic samples are constant within the probable limits of error, and the value coincides approximately with the average value found for terrestrial sulfur (Thode, Can. J. Research B27, 361(1949)). This ratio varies less than 0.1% for different meteorites, in sharp contrast with the large variations found in sulfur from terrestrial sources. It is suggested that the variations in isotopic content of terrestrial samples are due to fractionation that occurs in biological and geological processes because of differences in the chemical properties of isotopic molecules. Meteoritic sulfur has, evidently, not been subjected to the same fractionation processes.

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3969 Formation of Radioactive Surface Films on Minerals. T. G. Church. Can. J. Research 28A, 164-7(1950) Mar. (See also NSA 3-353.)

With the requisite chemical treatment, specific minerals will assume a surface radioactivity by undergoing reactions with radioactive ions in solution. It is essential that the minerals have a suitably tarnished or coated surface, since, in general, no exchange will occur on a fresh surface. It is suggested that the radioactivity so induced could be used in conjunction with a mechanical device to separate and concentrate the valuable minerals in an ore or to control hydrometallurgical plant processes. (auth)

3970 Kinetic Exchange Studies on Clays with Radioactive Calcium. J. W. Borland and R. F. Reitemeier. Soil Sci. 69, 251-60(1950) Apr.

By use of radioactive Ca^{45} it has been demonstrated that equilibration of Ca between the solution and solid fractions of aqueous systems of kaolinite, haloysite, hydrous mica, beidellite, and montmorillonite is complete or virtually so after shaking for 0.5 to 1 hr; the techniques used did not permit the study of shorter periods. Experiments with Ca^{45} indicate that the Ca of Ca-saturated clays replaceable by ammonium acetate is in kinetic equilibrium with the soluble Ca; these results offer direct experimental confirmation of a basic premise of cation exchange that cations of an element in solution are in kinetic equilibrium with the exchangeable cations of the same element. 14 references. (auth)

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3971 Summary of the Research Progress Meeting of March 9, 1950. Henry P. Kramer. UCRL-636, Mar. 17, 1950. 6p.

Research in the following topics is discussed: a modified time-of-flight mass spectrograph for the isotopic analysis of small samples; theory of p-p scattering at 32 and 340 Mev.

3972 Summary of the Research Progress Meeting of March 16, 1950. Henry P. Kramer. UCRL-647, Apr. 7, 1950. 6p.

Research in the following topics is discussed: π^+ mesons produced in p-p collisions by a deflected proton beam in a line target of liquid hydrogen; short-term effect of At^{211} on the blood picture in rats.

3973 Summary of the Research Progress Meeting of March 23, 1950. Henry P. Kramer. UCRL-650, Apr. 7, 1950. 9p.

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Research in the following topics is discussed: cosmic-ray research in France; γ rays from absorption of π^- mesons in hydrogen; light rare-earth isotopes, La^{133}, La^{134}, La^{135}, and Ce^{133}.

3974 On the Electric Properties of Thorium. Dietrich Bender. Z. Metallkunde 40, 257-60(1949) (in German).

The question was investigated whether thorium, like other elements of the fourth group of the periodic table, has more than one allotropic form. This was done by measuring the electrical resistance of samples of metallic thorium, 99.7% pure, at various temperatures. At 20°C the values 0.24 and 0.26 ohm.mm²/m were found for the specific resistance, and the values 2.3×10^{-3} and 2.7×10^{-3} for the temperature coefficient. The curves resistance/temperature show no discontinuities up to 1100°C. The same continuous character is displayed by the temperature gradient of the thermoelectric power of the couple Th/Pt. It follows that up to 1100° thorium remains in the same allotropic state. (auth)

3975 The Production of π^+-Mesons by Protons on Protons in the Direction of the Beam. W. F. Cartwright, C. Richman, M. N. Whitehead, and H. A. Wilcox. UCRL-665, Apr. 19, 1950. 8p.

A simple method has recently been developed for measuring the differential production cross sections of positive and negative π-mesons when various nuclei are struck by high-energy charged particles from the 184-in synchrocyclotron. In this method mesons and other particles leave a target and lodge in suitably arranged absorber blocks. Nuclear emulsions are embedded in these blocks to sample the population of stopped positive and negative π-mesons of all energies. The method is not very desirable for extreme forward angles, however, because the number of scattered beam particles relative to the number of mesons leaving the target rises very rapidly in the forward direction. This paper describes a subsequent method for making easy and reliable observations in the extreme forward direction. A magnetic field is produced in the region about the target. The external beam from the cyclotron traverses this target after being integrated by a calibrated ionization chamber. Positive and negative π-mesons leaving the target in the forward direction circle out and away from the beam on opposite sides. Broad channels are cut symmetrically in massive Cu shielding blocks, and positive and negative mesons possessing appropriate momenta are able to traverse these channels and to lodge in the absorber blocks. Nuclear emulsions are embedded in these blocks, as in the previous method. Some protons and other heavy charged particles also are able to traverse the channel on the positive side, but those which do so must necessarily possess roughly the same momenta as do the mesons. Hence their ranges will be much smaller than the meson ranges, and a complete separation is obtained between the positive π-mesons and the "background" of heavy charged particles coming from the target. On the negative side no trouble is to be expected from electrons because they do not ionize sufficiently heavily to leave background tracks in the nuclear emulsions employed. This technique for measuring meson production cross sections can easily be adapted for use over the entire meson energy and angular spectrum. Preliminary results are presented for 345-Mev protons with two targets, pure carbon and polyethylene, at an angle of observation of 0 ± 5 deg.

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3976 The Gamma Ray Spectrum from the Absorption of π^- Mesons in Hydrogen. Wolfgang K. H. Panofsky, Lee Aamodt, and Herbert F. York. UCRL-673, Apr. 1950. 11p.

The γ-ray spectrum resulting from the absorption of π^- mesons in high-pressure hydrogen has been analyzed by means of a pair spectrometer. The results are preliminary and of low accuracy; however, some of the implications of the experiment are of sufficient certainty at present to warrant discussion.

3977 Evidence for the Production of Neutral Mesons by Photons. J. Steinberger, W. K. H. Panofsky, and J. Steller. UCRL-674, Apr. 1950. 16p.

In the bombardment of various nuclei by 330-Mev x-rays, photons with the following properties are emitted: (1) at least two are emitted in coincidence; (2) they each have an average energy of about 100 Mev; (3) the Z dependence of the production indicates that they have their origin in a nuclear interaction and not in the Coulomb field; (4) the threshold for their production is at least 150 Mev; (5) the angular correlation of the photons shows that they are emitted in pairs as the only decay products of particles moving with velocities of the order of $v/c = 0.8$, and therefore of intermediate mass; (6) the total cross section for production from hydrogen is about the same as that for production of mesons; other light nuclei cross sections are somewhat higher than those for the positive mesons.

It is clear from these properties that the gamma rays are the decay products of neutral mesons. Since spin ½, and spin 1 mesons are forbidden to decay into two photons, the spin must be zero, excluding the possibility of very high intrinsic angular momenta. It seems reasonable, and it is in good agreement with all observations, to assume that both charged and neutral mesons are of the same type. It then follows from the angular distribution of the x-ray-produced π^+ mesons, and the high cross sections for making neutral mesons by x-rays, that the π meson is a pseudoscalar. This remakr applies, of course, only to the character of the meson, and not to any particular field theory for the interaction of mesons with nucleons. (auth)

3978 Cloud-Chamber Observations of the New Unstable Cosmic-Ray Particles. A. J. Seriff, R. B. Leighton, C. Hsiao, E. W. Cowan, and C. D. Anderson. Phys. Rev. 78, 290-1(1950) May 1.

Thirty-four "forked tracks" similar to two previously reported by Rochester and Butler (Nature 160, 855(1947)) have been observed in 11,000 cloud-chamber photographs of cosmic-ray penetrating showers, confirming their conclusion that new unstable neutral and charged particles exist. The lieftime of the neutral particles is found to be about 3×10^{-10} sec, and some information as to the nature of the decay products is given. (auth)

3979 Cosmic-Ray Bursts in Ionization Chambers of Different Materials. Harold W. Lewis. Phys. Rev. 78, 483-4(1950) May 15 (Letter to the editor).

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Measurements have been made of the cosmic-ray bursts in three cylindrical ionization chambers of different wall materials. The characteristics of the chambers and the burst sizes measured were such that nearly all the events were caused by nuclear disintegrations in the walls of the chambers (Bridge et al, Phys. Rev. 74, 1083(1948)). From a comparison of the counting rates the authors made an approximate calculation of the relative cross sections for star production in aluminum, silver, and gold. It was found that with the limits of experimental error the relative cross sections are proportional to $A^{2/3}$, where A is the atomic weight.

3980 Cosmic-Ray Induced Nuclear Disintegrations at 11,000 Meters. H. H. Forster. Phys. Rev. 78, 247-50(1950) May 1.

The equivalent absorption depth in air of the star-producing radiation is determined as 125 ± 8 g/cm^2 by means of the photographic-emulsion technique. The energy spectrum of α particles emitted in nuclear disintegrations is obtained. It is found that the fraction of the number of stars with given prong number to the total number of disintegrations is not strongly dependent upon altitude up to elevations of 11,000 m. The contribution of different cosmic-ray particles to star production is discussed. Electrons, photons, and light mesons are ruled out as the major agency for star production from consideration of their altitude dependence, π-mesons from consideration of lifetime and momentum. The results are shown to be consistent with the assumption of neutrons as the main star-producing agency. However, the fact that the penetrating showers also decrease exponentially with an absorption depth of 123 g/cm^2 suggests that the star-producing particle may be a by-product of penetrating showers, in which case the absorption depth of 125 g/cm^2 would be a measure of the creation rather than of the absorption of the star-producing radiation. (auth)

3981 Cosmic-Ray Intensity Following a Solar Flare. James W. Broxon and Howard W. Boehmer. Phys. Rev. 78, 411-14(1950) May 15.

Continuous records of the cosmic-ray intensity measured by a heavily shielded high-pressure ion chamber were obtained during and following an intense solar flare (of importance 3+) and a subsequent intense magnetic storm. No increase in C-R intensity was observed at or near the time of the flare, such as have been observed by others on similar occasions. At the peak of the magnetic storm there was a decrease of about 1.5% in C-R intensity, with full recovery requiring 2 or 3 days. Unshielded C-R telescope readings of low accuracy are included. These indicate that there were no prolonged alterations in the intensity (without shielding) of magnitude much greater than 14% associated with either the flare or the storm. (auth)

3982 The Cut-Off in the Energy Spectrum of Primary Cosmic Radiation. P. J. D. Gething. Phil. Mag. 41, 495-9(1950) May.

Janossy's explanation of the cutoff in the observed cosmic-ray energy spectrum, viz., that it is due to the action of the sun's magnetic field, was originally based on Hale's estimate for the dipole moment of the sun. A recent investigation by Thiessen, however, has led to a much smaller estimate. It appears that, if Janossy's calculations were corrected to allow for this new estimate, the calculated level of the cutoff would be greatly reduced, and consequently there should be a corresponding increase in the total intensity of incoming radiation observable at high magnetic latitudes. The possibility of an alternative explanation of the cutoff is considered, with particular reference to the theories of Milne (Relativity, Gravitation and World Structure, O.U.P., Chapter XII, 1935) and Fermi (Phys. Rev. 75, 1169(1949)). (auth)

3983 Detection of the π-μ-Decay with a Scintillation Crystal. W. L. Kraushaar, J. E. Thomas, Jr., and V. P. Henri. Phys. Rev. 78, 486-7(1950) May 15 (Letter to the editor).

Preliminary results are summarized of an experiment to determine the mean life of π^+ mesons. Mesons are produced in a carbon or beryllium target by γ rays from a synchrotron and counted by means of a scintillation counter. The lifetime was found to be $\tau = (1.65 \pm 0.33) \times 10^{-8}$ sec.

3984 The Effect of the Equatorial Ring Current on Cosmic Ray Intensity. Satio Hayakawa, Jun Nishimura, Takesi Nagata, and Masahisa Sugiura. J. Sci. Research Inst. (Tokyo) 44, 121-6(1950) Feb.

Assuming that the circular ring current (T. Nagata. Geophys. Notes 2, No. 18(1949)), concentric with the earth, is formed in the geomagnetic equatorial plane during magnetic storms, the authors calculate the behavior of a cosmic-ray particle in the combined magnetic field of the earth and of the ring current. Their results do not accord with the observed decreases in cosmic-ray intensity during severe magnetic storms, possibly because of an overly simplified ring-current theory.

3985 The Intensity of Primary Heavy Nuclei in the stratosphere at Night. J. J. Lord and Marcel Schein. Phys. Rev. 78, 484-6(1950) May 15 (Letter to the editor).

Free balloon flights in the stratosphere were conducted in order to investigate the flux of primary heavy nuclei and the rate of production of nuclear disintegrations during the night. The evidence presented indicates that there is a large change in the intensity of heavy nuclei between day and night. It is not clear whether or not this large diurnal variation applies only to heavy nuclei of relatively low energies. Within the experimental error of 5% the rate of production of stars was the same during the day and during the night, which indicates that the proton and α-particle components of the cosmic radiation do not exhibit any appreciable diurnal variation.

3986 The Magnetic Deviation of Cosmic-Ray Particles in the Atmosphere. W. F. G. Swann. Phys. Rev. 78, 243-6(1950) May 1.

This paper concerns the possibility of the path of a cosmic-ray α particle, proton, or mesotron being bent in the atmosphere by the earth's magnetic field in such a manner as to pass vertically upward through a counter telescope. In order to pass vertically upward through the telescope, it is necessary for the ray to have been horizontal at some

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time during its path; and taking into account the minimum energies necessitated by absorption along the path, it appears that, for a telescope at an altitude comparable with 100,000 ft, neither an α particle nor a proton would have "vertical room" between the telescope and the earth to describe the angle $(\pi/2)$ necessary to take it from the horizontal to the vertical upward direction. For a mesotron there would be room, but in this case the mesotron "mean life" operates to prevent the phenomenon from happening in appreciable degree; it is shown that regardless of energy or the law of energy loss, only a fraction $e^{-11.6}$ of any assigned number of mesotrons can live long enough to travel through a right angle in the earth's magnetic field. (auth)

3987 Nuclear Disruptions in the Stratosphere. M. Schein and J. J. Lord. Nuovo cimento 7, 21-7(1950).

A similar article by the authors (Nuclear Disintegrations as Detected with Electron-Sensitive Emulsions Exposed in the Stratosphere) was published in Phys. Rev. 77, 19(1950) and abstracted in Nuclear Science Abstracts as Abstract 4-1726.

3988 On the Origin of the Radio-Frequency Radiation and Cosmic Radiation in the Milky Way. Albrecht Unsold. Z. Astrophys. 26, 176-99(1949)(in German).

This article is similar to one published in Nature 163, 489-91(1949) Mar. 26, which was listed in Nuclear Science Abstracts as Abstract 2-1907.

3989 On the Possibility of Excitation, Due to an Electromagnetic Process, of Nuclei in Photographic Plates by Fast, Light Nuclei. Bernard d'Espagnat. Compt. rend. 230, 1268-70(1950) Mar. 27 (in French).

In examining tracks, due to the nucleonic component of cosmic rays, in photographic plates, heavy secondary tracks are sometimes observed to branch off from the primary track, although no signs of a nuclear reaction are found at the point of origin of the secondary track. It has been proposed that the secondary particle is a proton or α particle which has evaporated from a nucleus excited, electromagnetically, by the primary particle. The author considers the electromagnetic field of the incident particle as a cloud of virtual photons and uses a semi-empirical relation for the effective cross section of absorption photons by nuclei. It is concluded that the electromagnetic excitation of nuclei is a highly improbable process.

3990 On the Self-Energy of a Meson. E. Corinaldesi. Nuovo cimento 7, 77-8(1950)(Letter to the editor).

In a previous paper (Nuovo cimento 6, 520(1949)) the self-energy of a pseudoscalar meson was evaluated by using the energy-momentum representation, Pauli-Rose coordinates, and Pauli's regularization. It is shown here that the same result is obtained by using the method employed by Schwinger (Phys. Rev. 75, 651(1949)) for the calculation of the self-energy of a light quantum.

3991 The Positive-Negative Ratio for π-Mesons Produced Singly in Collisions of Nucleons with Complex Nuclei. Geoffrey F. Chew and Jack L. Steinberger. Phys. Rev. 78, 497(1950) May 15 (Letter to the editor).

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The primary purpose of this note is to point out that because of the Pauli principle the positive-negative ratio for π-mesons produced singly in collisions of nucleons with complex nuclei may be completely different from that due to collisions with an equal number of free nucleons. One must therefore be cautious in interpreting the meaning of this ratio when complex nuclei are used as targets for the neutron or proton beams from existing accelerators. A secondary purpose is to show that the exclusion principle leads one to predict a variation of the positive-negative ratio with meson and nucleon energies, the direction of the variation (but not the magnitude) being independent of detail properties of the π-meson, which are still unknown.

3992 High Level Polarization Tests on High Value Resistors. K. E. Burmaster. AECU-758, Oct. 28, 1949. 16p.

Polarization curves were established on several high-value resistors selected at random from an available supply. Results are more accurate than those previously obtained, careful consideration having been given to the R-C constant of the testing circuit. (auth)

3993 Induction Heater. Donald E. Hull. LA-1073, Feb. 20, 1950. 19p.

The induction heater described in this report has a maximum power output of 500 watts at a frequency between 300 and 400 kc. The power oscillator tube is a type 304TH, operating in a tuned-plate parallel-fed circuit. This type circuit has an inherent safety feature in that the high d-c plate potential does not appear at the output terminals of the unit. Provisions are made for remote control of the heating cycle. Detailed assembly drawings and circuit diagrams are included. (auth)

3994 Power Unit 1075A (A Stabilised Emission Ionisation Gauge Power Supply). J. E. Johnston. Atomic Energy Research Establishment Report No. AERE-G/R-487, Feb. 1950. 8p.

A power supply providing stabilized electron current for an ionization gauge and an amplifier to measure the positive ion current are described. Air pressures down to 5×10^{-8} mm can be measured. With a more sensitive meter a pressure of 5×10^{-9} mm can be measured. An addition which allows small changes of gas pressure to be detected is also described. This is useful when trying to detect leaks. (auth)

3995 Atomic Spectroscopy with Separated Isotopes. W. Walcher. Nucleonics 6, 28-36(1950) June.

Hyperfine structure analysis by means of the Fabry-Pérot interferometric spectroscope is described. The isotope-displacement effect and the resolution of h.f.s. components, in cases of multiplicity, by use of separated or enriched isotopes are illustrated. Since the intensities of h.f.s. components are in the same ratio as the isotope abundances, the "optical" method can in some cases replace the mass spectrometer with advantage.

3996 Element 98. S. G. Thompson, K. Street, Jr., A. Ghiorso, and G. T. Seaborg. Phys. Rev. 78, 298-9(1950) May 1 (Letter to the editor).

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Definite identification has been made of an isotope of the element with atomic number 98 through the irradiation of Cm^{242} with 35-Mev helium ions in the Berkeley Crocker Laboratory 60-in. cyclotron. The isotope which has been identified has an observed half-life of about 45 min and probably has the mass number 244. The observed mode of decay of the 98^{244} is through the emission of α particles, with energy about 7.1 Mev, which agrees with predictions, and other considerations involving the systematic of radioactivity in this region indicate that it should also be unstable toward decay by electron-capture.

3997 Isotope Effect in the Superconductivity of Mercury. Emanuel Maxwell. Phys. Rev. 78, 477(1950) May 15 (Letter to the editor).

An investigation was made of the superconductivity of samples of natural Hg and of the isotope Hg^{198}. The results indicate that the transition temperature of a superconductor is a function of the nuclear mass; the lighter the mass, the higher the transition temperature.

3998 Masses of Cr^{50}, Cr^{52}, and Fe^{54}. Henry E. Duckworth and Howard A. Johnson. Phys. Rev. 78, 179 (1950) Apr. 15 (Letter to the editor).

A double-focusing mass spectrograph has been used to photograph the doublets at mass numbers 25, 26, and 27 formed by doubly charged Cr^{50}, Cr^{52}, Fe^{54} and singly charged C_2H, C_2H_2, and C_2H_3. The following mass values were thus found:

Cr^{50}: 49.96040 ± 0.00020
Cr^{52}: 51.95741 ± 0.00021
Fe^{54}: 53.95664 ± 0.00027

3999 Masses of Pd^{104}, Pd^{108}, Pt^{195}, and Cu^{65}. Henry E. Duckworth, Karl S. Woodcock, and Richard S. Preston. Phys. Rev. 78, 479-80(1950) May 15 (Letter to the editor).

A double-focusing mass spectrograph has been used to photograph a number of doublets formed by singly charged hydrocarbon molecules and multiply charged palladium and platinum atoms. These photographs have been used to obtain precise values for the masses of Pd^{104}, Pd^{108}, and Pt^{195}.

Nuclide	Packing fraction × 10^4	Mass
Cr^{50}	−7.96 ± 0.05	49.96020 ± 0.00025
Cr^{52}	−8.25 ± 0.05	51.95710 ± 0.00026
Fe^{54}	−8.03 ± 0.05	53.95664 ± 0.00027
Cu^{65}	−7.87 ± 0.05	64.94884 ± 0.00032
Pd^{104}	−6.12 ± 0.05	103.93635 ± 0.00052
Pd^{108}	−5.85 ± 0.04	107.93682 ± 0.00043
Pt^{195}	+1.36 ± 0.04	195.02652 ± 0.00078

4000 New Isotopes of Neptunium. L. B. Magnusson, S. G. Thompson, and G. T. Seaborg. Phys. Rev. 78, 363-72(1950) May 15.

Evidence is presented for three new, light neptunium isotopes formed by deuteron bombardments of U^{233}, U^{235}, and U^{238}. The isotope Np^{231} has a half-life of 50 ± 3 min and emits α particles of 6.28 Mev energy; the proportion of decay by electron capture has not been determined. The isotope Np^{233} decays predominantly by electron capture with a 35 ± 3-min half-life; it has an α-decay half-life roughly determined to be about 10 years, corresponding to a K/α-branching ratio of 1.5×10^5, and the α particles have an energy of 5.53 Mev. A 13 ± 3-min period with electromagnetic radiation, indicating orbital electron capture, is attributed to Np^{232}. Approximate cross sections for formation of various neptunium isotopes by dueterons of energy from 15 to 100 Mev have been determined. The cross sections are low, of the order of 10^{-28} cm^2, possibly because most of the excited nuclei undergo fission. (auth)

4001 Superconductivity of Isotopes of Mercury. C. A. Reynolds, B. Serin, W. H. Wright, and L. B. Nesbitt. Phys. Rev. 78, 487(1950) May 15 (Letter to the editor).

The superconductivity of mercury samples enriched in various isotopes was investigated. A systematic decrease of transition temperature with increasing mass was found.

Sample	Average mass No.	Transition temperature (°K)
1	203.4	4.126
2	202.0	4.143
3	200.7	4.150
4	199.7	4.161

4002 Introduction of Measured Liquid Samples into the Mass Spectrometer. C. Edward Wise, Robert M. Reese, Vernon H. Dibeler, and Fred L. Mohler. J. Research Natl. Bur. Standards 44, 215-20(1950) Mar.

Several methods of introducing measured amounts of liquid samples of neohexane and of styrene into a mass spectrometer are compared by measuring the sensitivity (ion current per unit pressure) on mass peaks 71 and 104. A precision microburet and pipet made of thermometer tubing were used to introduce samples of about 0.0015 ml. A reproductibility of about 2% is obtained with the microburet and of 5 to 8% with the pipet. Sensitivities obtained by either method are lower than the sensitivity obtained by a direct pressure measurement using a micromanometer. They are low by 13% for neohexane and by 30% for styrene. Styrene is retained on the glass walls and in the stopcock grease, and after pumping out 20 min, some styrene is gradually evolved. (auth)

4003 Some New Mass Comparisons Involving Si, Fe, Ni, Cu, Zn, W, and Pt. Henry E. Duckworth, Howard A. Johnson, Richard S. Preston, and Richard F. Woodcock. Phys. Rev. 78, 386-90(1950) May 15.

A number of mass comparisons have been made, using a large Dempster-type mass spectrograph with a spark source. Packing fraction differences have been obtained for the doublets Si^{28}-Fe^{56}, Si^{29}-Ni^{58}, Si^{30}-Ni^{60}, W^{183}-Ni^{61}, W^{186}-Ni^{62}, Pt^{192}-Zn^{64}, Pt^{195}-Cu^{65}, Pt^{196}-Zn^{66}. The following packing fractions were obtained:

Fe^{56}: −8.52 ± 0.05
Ni^{58}: −8.09 ± 0.05
Ni^{60}: −8.54 ± 0.02 (auth)

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4004 Completion Report on Improved Alpha Survey Instrument and Probe. R. W. Schede. K-504, Mar. 30, 1950. 51p.

A battery-operated α survey meter of the ionization-chamber type has been developed which is five times more sensitive and is more stable than the Zeuto now being used. The calibration is independent of normal variations so that a meter scale directly calibrated in counts per minute is incorporated. A probe for checking surfaces of odd contour has also been developed for use with this instrument. Details of construction, operation, maintenance, and operating characteristics are given for both the meter and the probe. (auth)

4005 Absolute Determination of the Emission Rate of Beta Rays. R. K. Clark. NYO-1506, Mar. 15, 1950. 33p.

A technique for the absolute determination of the rate of disintegration of β-particle emitters is described. The method consists in measuring the rate at which charge is carried away from the active material by the emitted electrons. A Lindemann electrometer in conjunction with a compensating condenser is used as the measuring apparatus. The effects of ionization are eliminated by placing the material in a high vacuum. The effects of the surroundings (excluding the parts required to support the active material) are reduced by using a tank of large dimensions, and the magnitude of these effects is determined by the use of supplementary surrounding surfaces with various potentials applied to them. Some information is obtained about the effects of the source-supporting structures by placing over the active side of the source-supporting foil a cover foil identical to it. Date from measurements with P^{32} and Na^{22} show that this technique makes possible the measurement of β-particle activities with high accuracy. (auth)

4006 A Scintillation Counter for Measurement of I^{131} Uptake in the Thyroid Gland. William J. McIntyre. NYO-1605, May 3, 1950. 20p.

A scintillation counter using anthracene crystals for detection of I^{131} uptake in the thyroid gland has been constructed. Improvement over the conventional Geiger counter and scaler setup as previously used has been achieved by a factor of 30 ~ 50 in sensitivity. A 6-week period of clinical use of this counter is compared with use of the Geiger counter. A discussion of the response of 5 phosphors (anthracene, naphthalene, naphthalene with anthracene activator, 0.1% thallium-activated potassium iodide, and dihydro-anthracene to the γ rays of I^{131}) is included, along with a description of the equipment employed. 12 references. (auth)

4007 Automatic Isodose Recorder with Scintillation Counter as Gamma-Ray detector. G. J. Hine, M. Berman, and M. M. Elkind. Rev. Sci. Instruments 21, 362-5(1950) Apr.

This paper describes an instrument for investigating the radiation field of any type of γ-ray source. A small calcium tungstate crystal, together with a light-conducting quartz rod and a 1P21 photomultiplier tube, is used as γ-ray detector. The lines of constant radiation intensity in a selected plane (isodose curves) are recorded automatically with a good accuracy in a short period of time. (auth)

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4008 Calcium and Cadmium Tungstate as Scintillation Counter Crystals for Gamma-Ray Detection. R. H. Gillette. Rev. Sci. Instruments 21, 294-301(1950) Apr.

The high density, transparency, and chemical inertness of calcium and cadmium tungstates, with their reasonable luminescent efficiencies when stimulated with high-energy radiation, strongly suggest their use as phosphors in scintillation counters for γ-ray detection. Some of the properties of these crystals are reported and compared with anthracene. It is shown that with proper design, the total anode current produced by a given source is several times greater with the tungstates than with anthracene, although the latter has a more favorable pulse-size distribution. Cadmium tungstate has a zero temperature coefficient of luminescence up to 40°C and shows no afterglow after exposure to intense radiation. (auth)

4009 Construction and Performance of a Multiple Gamma-Ray Counter of High Efficiency. Tibor Gráf. Rev. Sci. Instruments 21, 285-93(1950) Apr.

A multiple γ-ray counter composed of 24 counter tubes connected in parallel is described. The tubes have Bi-plated brass-screen cathodes and are placed inside the same envelope. Relative and absolute values for the efficiency of the counter were determined experimentally in the range 0.28 to 2.62 Mev. Compared to a single brass counter of similar dimensions, the multiple counter shows for γ rays of, for example, 0.7 Mev energy a tenfold increase in efficiency. Its starting voltage is 5 to 600 v lower. The "effective resolving time" of the multiple counter appears to be 3 to 4 μsec. The counting-rate curve seems to follow the inverse square law down to the shortest counter-source distances. The solid angle subtended by the multiple counter for sources, placed in its middle, is nearly 4π. (auth)

4010 A Direct Reading Apparatus for the Measurement of the Dead Time and Recovery Time of Geiger Counters. Georg W. Epprecht. Helv. Phys. Acta 23, 291-8(1950)(in German).

A circuit is described which permits direct-reading measurements of dead time and recovery time of Geiger counters. The basic circuit uses an R-C-discharge, controlled by a scale of 2, as the means for time measuring. The shortest interval of successive pulses is selected and indicated. Some results obtained with the set are shown. (auth)

4011 The Effect of Magnetic Fields on the Response of Gamma-Scintillation Counters. J. D. Graves. Phys. Rev. 78, 309-10(1950) May 1 (Letter to the editor).

A marked change in the response of scintillation detectors has been observed with their use in magnetic fields. The extent of this effect has been determined for several conditions. A 1P21 photomultiplier tube and a phosphor were mounted in a light-tight brass cylinder, and the cylinder was placed in a long, stationary solenoid. Variable direct current through the solenoid windings was used to produce axial magnetic fields, and a constant voltage was applied to the photomultiplier. Radium was used as the source of γ radiation. Plots are given of the counting rate as a function of the applied fields for each of the two phosphors used, and integral bias curves are given for two values of the field.

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4012 Electrical Apparatus for Automatically Furnishing the Distribution in Time of Nuclear Events (Particle Emission). Jean Thibaud and Roland Chéry. Compt. rend. 230, 83-5(1950) Jan. 2 (in French).

This article describes some improvements in a device previously built (Compt. rend. 218, 873(1944)). This device automatically records the time intervals between successive nuclear events for statistical studies. The length of each interval is represented by the position of a spot on the face of an oscilloscope. If the scope face is photographed, the distribution of the time intervals may be determined from the density of spots in different parts of the photograph. The mechanical switches included in the previous design have been replaced by electronic switches.

4013 The Electrical Field in a Geiger Counter. Arthur R. Laufer. Rev. Sci. Instruments 21, 252-4(1950) Mar.

The mechanism of the reduction and recovery of the electric field in a Geiger counter is discussed, and the role of the series resistance is analyzed. The contribution of the collection of the electrons to the total pulse size is shown to be negligible. (auth)

4014 Electron Component in Geiger Discharge. G. G. Delley, W. H. Jordan, and P. R. Bell. Rev. Sci. Instruments 21, 330-2(1950) Apr.

Observation of the wave form of current during a Geiger discharge indicates the presence of a component due to electron collection amounting to as much as 50% of the total energy involved in the discharge. It appears, therefore, that the initial ion sheath can have a mean radius of the order of 10 to 15 times the radius of the center wire. Apparatus is described, wave forms are shown, and the methods used to evaluate electron component and mean radius of ion sheath are indicated. Results for two tubes with different quenching vapors are tabulated. (auth)

4015 Evaluation of Neutron Counter Efficiency. J. E. Draper. Nucleonics 6, 32-40(1950) Mar.

The problem discussed is that of a very long cylinder of BF_3 embedded in an infinite space of paraffin, with an annular ring of free space between cylinder and paraffin. Throughout the paraffin a constant production rate of thermal neutrons is assumed. The resulting absorption rate in the BF_3 cylinder is determined by using diffusion theory in the paraffin and a boundary condition determined by matching fluxes at the paraffin surface. An estimate is also made of the effect of the counter wall.

4016 Decade Pulse Counter for Geiger-Mueller Tubes. Björn Astrőm. Rev. Sci. Instruments 21, 323-6 (1950) Apr.

A pulse counter of decade type, which does not require any components with narrow tolerances, has been designed. A direct-reading system for the total count has been used, which eliminates all calculations. Several instruments of the type described here have been put to daily use for more than half a year without any failure. (auth)

4017 Geiger Counter for Civilian Defense Use. H. D. LeVine, H. J. DiGiovanni, and M. R. Coe. Nucleonics 6, No. 6, 56-9(1950) June.

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The authors report the design and performance of a simple-type low-cost Geiger counter. The essential features of this counter are two 1.5-volt flashlight cells for power, a reed vibrator and transformer to supply 700 volts for the Geiger tube, a cold cathode rectifier with a corona voltage regulator tube, a neon light to indicate the condition of the batteries, a halogen-quenched counter tube, and a meter and earphones. The meter has a single scale with logarithmic response from 50 to 3,000 mr/hr.

4018 A High Pressure Fitting for Scintillation Counting. K. D. Timmerhaus, E. B. Giller, L. H. Tung, R. B. Duffield, and H. G. Drickamer. Rev. Sci. Instruments 21, 261-2(1950) Mar.

A scintillation crystal, in conjunction with a photomultiplier, may be used in tracer work to make continuous analyses without sampling. This is especially advantageous in high-pressure systems, particularly near the critical point where sampling would considerably disturb conditions. For these cases the crystal is placed inside the apparatus, and the light is conducted out by a lucite or quartz rod. The authors have designed a high-pressure seal for such applications through which a lucite rod extends into a high-pressure bomb, making contact with the scintillation crystal.

4019 Investigation of Color Centers by a Single-Photon Counting Method. A. J. Dekker and A. H. Morrish. Phys. Rev. 78, 301(1950) May 1 (Letter to the editor).

NaCl and KBr crystals were irradiated with 55-kev 3-ma x-rays. The x-ray energy absorbed by the crystals was partly stored in the form of excited electrons trapped by lattice defects. The excited electrons then combined with the holes, whereupon photons were emitted, which were detected with a photomultiplier. The counting rate as a function of time after irradiation with x-rays is given. It is shown to decrease strongly as the temperature is lowered. The authors conclude, therefore, that direct recombination of a trapped electron with a hole in the upper filled band is very unlikely and that recombination can only take place after the electrons are excited into the conduction band.

4020 Liquid Scintillation Counter. George T. Reynolds, F. B. Harrison, and G. Salvini. Phys. Rev. 78, 488(1950) May 15 (Letter to the editor). (See also NSA 4-3773.)

The scintillation properties of various liquids were investigated through a study of the light flashes produced by ionizing particles. Measurements were made on the following solutions and liquids: naphthalene in benzene, naphthalene plus anthracene in benzene, terphenyl in benzene, dibenzyl in ether, anthracene plus naphthalene in xylene, terphenyl in xylene, benzene, ether, xylene, and melted dibenzyl. The counting efficiencies of a number of these are presented.

4021 Magnetic Field Calculations for Large Cross-Section Cloud-Chamber Coils. H. W. Koch. J. Applied Phys. 21, 387-95(1950) May.

A method is described and equations are presented which permit the calculation of the magnetic field characteristics of large cross-section air-core coils. The method is ap-

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plied to the determination of the field nonuniformities on the median plane to be expected with annular cloud-chamber coils of rectangular cross section. The field nonuniformity results are provided in graph form to facilitate the design of cloud-chamber coils. (auth)

4022 A Microcalorimeter Suitable for Study of Easily Absorbed Nuclear Radiations. C. V. Cannon and G. H. Jenks. Rev. Sci. Instruments 21, 236-40(1950) Mar.

A microcalorimeter suitable for measuring the energy of easily absorbed nuclear radiations is described. The calorimeter is an isothermal type operating at the temperature of liquid nitrogen and using the rate of vaporization of nitrogen under constant pressure as a measure of the heat input. The calorimeter is fairly simple to construct and to operate and has a short equilibration period. Heat inputs to the calorimeter as low as 7×10^{-6} cal/sec can be measured with an accuracy of 1%. (auth).

4023 New Multiplier Phototubes of High Sensitivity. A. Sommer and W. E. Turk. J. Sci. Instruments 27, 113-17(1950) May.

The development of a new type of multiplier phototube, originally designed for television purposes, is described. The tube combines high cathode sensitivity and high multiplication factor with low noise/signal ratio. A special feature is the large area of the photocathode which is advantageous when a light beam of large cross section has to be intercepted. Modified versions of the tube (types 5060 and 5311) have a photocathode consisting of a semitransparent layer deposited on a flat window. In this form the tube has proved particularly suitable for scintillation detection in nuclear research. (auth)

4024 A Note on Perforated Cathode Self-Quenching G-M Counters. O. Parkash. Current Sci. 18, 337-8 (1949) Sept.

A brief discussion of mechanisms of formation of spurious counts is given, and it is pointed out that the use of gauze cathodes should lead to the reduction of spurious counts in many cases. Experiments are described with argon/alcohol-filled counters of normal size in support of the new suggestion. With a plane Cu cathode the plateau slope (over about 210 v) was 0.06%/v, and with a gauze (Cu) cathode the plateau slope was practically zero.

4025 Notes on the Production of Geiger-Mueller Counters and the Discharge Mechanism. Kazuji Hashimoto. J. Phys. Soc. Japan 3, 153-6(1948) Mar.-June.

The author presents several experimental curves showing the performance characteristic of a G-M tube as a function of the pressure ratio of the alcohol and argon in the tube and discusses these curves in light of the theory for the mechanism of the discharge. He also discusses a method for obtaining the same alcohol-argon pressure ratio in a number of tubes by arranging them radially around the filling tube instead of longitudinally along it.

4026 Further Experiments on the Parallel Wire-and-Plate Type Counter. Kazuzi Hashimoto, Munemarie Imai, and Heiichi Hagiwara. J. Phys. Soc. Japan 4, 176-7(1949) Mar.-Apr.

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The authors discuss the discharge induced on one of the central wires of a counter by the discharge of a neighboring wire.

4027 On the Functioning of the Spark Counter of α Particles. R. Ricamo. Nuovo cimento 7, 49-54(1950) (in Italian).

The working limits of the Greinacher spark counter (Z. Physik 16, 165(1935)) for α particles were determined experimentally. In addition to the findings of Connor (Nature 163, 540(1949)), it is shown that, owing to a corona effect, the effective tension between the electrodes is considerably lower than the supply tension. The effects of the distance between the electrodes and the diameter of the filament were studied; thus, it was found that, for a supply tension of 4,500 v and a distance between the electrons of about 1 mm, the counter did not work if the diameter of the filament was smaller than 20 μ or larger than 150 μ. (auth)

4028 On the Photo-Sensitivity of Neon Lamps and Their Use in Cosmic-Ray Circuits. O. Parkash. Current Science 18, 400-1(1949) Nov. (Letter to the editor).

The striking potentials of three types of commercial gas-filled discharge tubes [GEC:NE-17, NE-2(neon); E5541-A-F-36 (argon)], measured under different conditions of illumination from an Hg vapor lamp, were found to be considerably reduced by direct illumination, less with a blue filter, and unchanged with green and yellow filters, from those with stray light only; the running potential and current were unaffected. It is suggested that Ne tubes which must be used in cosmic-ray (e.g., coincidence) circuits should be painted red to eliminate the effect of light.

4029 On the Relations Between Crystal Counters and Crystal Phosphors. Rudolf Frerichs. J. Optical Soc. Am. 40, 219-22(1950) Apr.

It is shown that all crystals which yield pulses under irradiation with nuclear particles or γ rays belong to the class of crystal phosphors. They show luminescence by irradiation in the absorption band, a power law of decay, and primary and secondary photocurrents. This statement is proven for CdS, ZnS, AgCl, AgBr, TlCl, diamond of the Type 2, and solid argon. A search for new and better counting crystals among the large number of natural and artificially prepared crystal phosphors might thus be promising. (auth)

4030 On the Theory of β-Ray Spectrometers Utilizing a Uniform Axial Magnetic Field. Pierre Hubert. Compt. rend. 230, 1464-5(1950) Apr. 17 (in French).

Du Mond (Rev. Sci. Instruments 3, 160(1949)) and Persico (ibid., 191(1949)) have recently published papers on the theory of β-ray spectrographs with uniform axial magnetic field. The author discusses variations in the arrangement of focusing diaphragms considered by these authors and the type of response curves (curves giving the number of electrons received at the focus as a function of the magnetic field strength, when the source emits monoenergetic electrons) produced by these diaphragm arrangements.

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4031 The Photographic Emulsion Technique in Nuclear Research. P. M. Aitchison. Australian J. Sci. 12, 57-61(1949) Oct.

This is a review of the use of photographic emulsions for nuclear research. After a discussion of the fundamental physical processes involved (ionization, scattering, etc.), the author describes the various types of emulsions now available, their processing, special differential development, and calibration. Finally, mention is made of scanning the photographic plates and the methods involved in their interpretation.

4032 Photographic Methods of Measuring Slow Neutron Intensities. M. Blau, I. W. Ruderman, and J. Czechowski. Rev. Sci. Instruments 21, 232-6(1950) Mar.

The relative slow-neutron sensitivities of β-sensitive emulsions, x-ray film–indium foil combinations, and boron-loaded plates were investigated. Since the detection efficiency depends upon the neutron energy, experiments were made with epithermal, thermal, and cold neutrons. β-sensitive emulsions and x-ray–indium combinations are about equally useful for the detection of epithermal neutrons. B^{10}-loaded plates, which are best for the detection of thermal and cold neutrons, have the following advantages: very low neutron intensities can be measured by microscopic counting of α tracks, neutrons can be counted in the presence of β and γ radiation, the number of α tracks is essentially independent of the development conditions, and a wide range of neutron intensities can be measured with a single plate. (auth)

4033 A Photo-Multiplier Gamma-Ray Detector. J. D. Graves and G. E. Koch. Rev. Sci. Instruments 21, 304-7(1950) Apr. (See also NSA 3-457.)

The sensitivity of the RCA 1P21 photomultiplier to γ radiation has led to the investigation of the characteristics of this tube as a γ-ray detector. The range, linearity, directional dependence, temperature dependence, applied voltage regulation requirements, and radiation-energy dependence were determined for several tubes. Preliminary results concerning the ability of the tube to maintain a calibration are given. A basic circuit for such a detector is given. (auth)

4034 Progress Report of Electronics Branch for February, 1950–March, 1950. N. F. Moody. National Research Council of Canada Report No. PR-P-6-E, nd. 7p.

The activities of the Design and Development Section are reported briefly under the following topics: scintillation counters (aerial prospecting, gas discharge scaler); millimicrosecond techniques (0.1 to 200 Mc/sec amplifier, 20 Mc/sec counting system, 60 Mc/sec amplifier); pneumatic carrier capsule detection; anticoincidence unit for fission-particle experiments; SU1B radiation monitor; fast linear amplifier AEP 1444; scaler AEP 908 (auto-control units); kicksorter.

The activities of the Services and Supply Section are also briefly reported.

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4035 Proportional Counters. I. Serge A. Korff. Nucleonics 6, No. 6, 5-10, 36(1950) June.

The theory, design, and operating characteristics of proportional counters are briefly discussed. The proportional, limited proportionality, and Geiger regions in the counter operation are compared as to sensitivity, type of response to an ionizing event, and dead time.

4036 Reabsorption of Fluorescence Radiation Produced in a Gas Filled Ionization Chamber, or in a Counter. H. Tellez-Plasencia and P. Théron. J. phys. radium 11, 93-6(1950) Feb. (in French).

The roentgen radiation absorbed in a gas-filled container releases part of its energy to photoelectrons and recoil electrons, but part of its energy is re-emitted in the form of fluorescence radiation. Some of this fluorescence energy escapes from the container, but the rest is reabsorbed. The author calculates the amount of energy reabsorbed. This quantity may also be measured experimentally by varying the dimensions of the container.

4037 Scintillation Conducting Rods in Tracer Work. K. D. Timmerhaus, E. B. Giller, R. B. Duffield, and H. G. Drickamer. Nucleonics 6, No. 6, 37-41(1950) June.

Various light-conducting media for scintillation counters are evaluated, particularly as to their use in rod form for tracer work where a small crystal is to be inserted into a system. Lucite is found more conductive and adaptable than plexiglass or polystyrene. Tabulations are made of counts per minute received from various fixed radioactive sources through rods of different diameters, lengths, and degrees of bending.

4038 The Scintillation Counter as a Low Resolution Gamma-Ray Spectrometer. Robert W. Pringle, Kenneth I. Roulston, and Harry W. Taylor. Rev. Sci. Instruments 21, 216-18(1950) Mar.

A scintillation γ-ray spectrometer has been developed, which is of particular use for the study of isotopes of low specific activity and in which the energies of the γ rays are identified from the pulse-height distributions of the recoil electrons produced in an activated NaI crystal. The Compton distributions are easily recognized, and a study of the γ radiation of Co^{60} and I^{131} shows a proportionality to exist between the total light output per scintillation and the energy of the corresponding secondary β-ray particle. The noise level of the RCA 5819 photomultiplier, as used in this test, corresponded to an energy on the pulse-height scale of less than 20 kev. A brief description is given of a new type of differential pulse-height analyzer which has been developed for work of this type. (auth)

4039 A Simple Combination Micromicroammeter and X-ray Ionization Chamber. Roy S. Anderson. Am. J. Phys. 18, 119-24(1950) Mar.

The author describes a small portable apparatus consisting of an ionization chamber and an amplifier capable of being detached for separate use as a microammeter. This device is designed primarily for the comparison of x-ray intensities and may be used either with d-c or a-c operated x-ray tubes.

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4040 A Study of Plateau Slopes in Self-Quenching Geiger-Mueller Counters. Sanborn C. Brown and Claudine Maroni. Rev. Sci. Instruments 21, 241-4(1950) Mar.

A study of plateau slopes of self-quenching Geiger-Mueller counters shows that no quenching vapor tested produced flat characteristics. On the assumption that the slopes were given by spurious counts arising from the gas-discharge phenomena, a study was made of the controlling factors. Neither the quenching gas nor the vehicular gas positive ions were found to be significant. A study of the negative ions, produced by molecular dissociation of the quenching gas at the cathode, and electron attachment in the body of the gas shows that these factors are directly correlated with the slopes of the plateau characterisics. (auth)

4041 The Temperature Dependence of Organic Scintillation Counters. S. H. Liebson and J. W. Keller, Jr. Phys. Rev. 78, 305(1950) May 1 (Letter to the editor).

The temperature dependence of the light output of organic phosphors when subjected to γ radiation was measured in different crystals and mixtures. The photomultiplier used for detection was kept at liquid nitrogen temperatures, while the crystal temperature could be varied in a separate insulated chamber. The light output was guided to the photomultiplier by means of a lucite rod or hollow aluminum tube, depending on the type of crystal to be investigated. Measurements were made of the pulse distributions and total light output under γ-ray excitation from a radium source.

4042 A Thin-windowed Miniature Geiger-Mueller Counter. E. R. Rae. J. Sci. Instruments 27, 143(1950) May.

In the course of work involving measurements on positron-electron pairs, the author found it necessary to construct a Geiger counter with the following characteristics: small size to give low background, large side window thin enough to pass fairly soft electrons, and high efficiency in counting very hard electrons. To satisfy these requirements, a counter was constructed from a piece of thin-walled brass tubing with a section cut away to form a window. Inside this tube and forming both the cathode and the window was soldered a cylinder of copper foil 0.001 in. thick. The tube was outgassed and then filled differentially with 2 cm of ethylene and 80 cm of argon. The counter was found to be fast in action, with a plateau of 200 to 300 v and a threshold at 1,200 to 1,500 v. It was found just as easy to use copper foil of half the thickness quoted above, i.e. of 0.0005 in.; the use of thin foils of aluminum and dural was not, however, successful, since these were invariably found either initially to possess pinholes or else to develop them when subjected to pressure for a few hours or days.

4043 Time Lags in Geiger Counters. Arthur R. Laufer. Rev. Sci. Instruments 21, 244-51(1950) Mar.

Light from a spark was used to produce a primary ionizing event in a Geiger counter by means of the photoelectric effect. The time lag between this event and the detection of the pulse on the counter wire was studied as a function of counter filling, pressure, and overvoltage. The measured lags, ranging from tenths of microseconds to many microseconds, were used to calculate electron mobilities, sheath-

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spread velocities, and electron-attachment coefficients. The lags appear to be the result of the transit time required by the initial electrons to move from their point of origin to the high field region and the time required by the sheath to spread laterally along the wire and to move radially outward far enough to produce an electrical pulse which can be detected. (auth)

4044 Quadrupole Moment of the Electron Distribution in Hydrogen Molecules. Norman F. Ramsey. Phys. Rev. 78, 221-2(1950) May.

The rotational magnetic moment and the dependence of the diamagnetic susceptibility on the orientation of the molecule's rotational angular momentum can be combined to give an experimental determination of the quadrupole moment of the electron distribution in hydrogen molecules. The results of this analysis are that the mean value of $\Sigma_j(3z_j^2 - r_j^2)$ with z taken along the internuclear axis of the molecule is $(0.38 \pm 0.15) \times 10^{-16}$ cm^2. Alternatively, if the z axis is the axis of quantization, the mean value of $\Sigma_j(3z_j^2 - r^2)$ in the rotational state $M_J = J = 1$ is $(0.076 \pm 0.030) \times 10^{-16}$ cm^2. (auth)

4045 Neutron-Deuteron Scattering at High Energies. Frederic De Hoffmann. Phys. Rev. 78, 216-20 (1950) May 1.

Stationary-state perturbation theory is applied to the problem of n-d scattering at high neutron energies. The Born approximation is used, and exchange, but not tensor, forces are considered. It is shown that the n-d cross section, even in the case of general exchange forces, is made up of three distinct contributions: the cross sections for the scattering of the incoming neutron from the bound proton or neutron, respectively, averaged over the momentum distribution of the particle in the deuteron, the cross-terms due to interference, and the Pauli principle. (auth)

4046 Neutron Production by Complete Absorption. Joseph S. Levinger. Nucleonics 6, 64-7(1950) May.

Calculations of neutron yield per high-energy photon completely absorbed in an absorber of high atomic number are outlined, with indications of their usefulness in cosmic-ray research, studies of photonuclear reactions, and neutron-background evaluation in electron-accelerator experiments. (auth)

4047 Neutron Production by Proton Bombardment below the (p,n) Threshold. B. Jennings, H. A. Leiter, and K. H. Sun. Westinghouse Research Laboratories, Mar. 20, 1950. 11p. (AEC File No. NP-1441.)

A study of neutron backgrounds with the proton beam bombarding targets at voltages far below the accepted (p,n) thresholds has shown that, at least with targets of deuterium and beryllium, the number of neutrons observed could not be accounted for by normal background considerations. The neutron yield of protons on D_2O as compared with H_2O under similar conditions in the energy range between 900 to 1,900 kv

and the similar effect of protons on a thick Be target in the voltage range between 600 kv and the threshold at 2.059 Mev are shown. The small neutron yields observed below the threshold in D and Be are ascribed to a complex double processes in which energetic deuterons are formed first and in turn yield neutrons by a secondary (d,n) process. 17 references.

4048 Neutron Production in Various Substances by 50-Mev X-Rays. G. C. Baldwin and F. R. Elder. Phys. Rev. 78, 76-7(1950) Apr. 1 (Letter to the editor).

Measurements of rates of production of neutrons by 22-Mev x-rays in various materials have been reported by Price and Kerst (Phys. Rev. 76, 182A(1949)). The measurements reported in this letter were made by the same technique. Fast photoneutrons emitted at 90 deg were detected, after moderation, by the 44-sec Rh^{103} activity. The moderator, a 6-in. cube of paraffin, was surrounded on all sides by a cadmium-lined paraffin shield 8 in. thick; a 3-in. cadmium-lined hole in the shield allowed neutrons from a sample placed in the x-ray beam from a 50-Mev biased betatron to enter the detector. An aperture in a lead shielding wall defined a beam 8.3 cm in diameter at the sample position, 3 m from the target. An R thimble in a ⅛-in. lead intensifier on the beam axis at 4.69 m was used in conjunction with a monitoring rhodium foil placed close to the betatron to determine the exposure, transmission, and absorption of radiation by the sample. Absolute neutron yields were computed from these data after a calibration exposure with a 200-mc Ra-α-Be source at the sample position. A plot is given for the neutron yield per mole as a function of the atomic number over the entire range of atomic numbers.

4049 Pile Neutron Research Techniques. III. D. J. Hughes. Nucleonics 6, No. 6, 50-5(1950) June.

This article is an evaluation of neutron standards in terms of source, strength, flux, and temperature. A description of the method of calibration of a Ba-Be neutron source at Argonne and Los Alamos and the comparison of unknown sources in terms of the known source are given. Using a given source, it is possible to calibrate the flux from it, using indium foils and Cd difference measurement in graphite, where the spacial distribution of neutrons can be accurately calculated. Fluxes can also be measured by using absorbers (boron, gold foil) whose cross section has been measured very accurately. Neutron temperatures (energy) can be measured by measuring the cross section of the beam with a 1/v absorber such as boron. Beam measurements inside the pile can be effected by observing the change in reactivity induced by the insertion of an 1/v element (boron) in the pile. 15 references.

4050 Radioactive Decay of the Neutron. J. M. Robson. Phys. Rev. 78, 311-12(1950) May 1 (Letter to the editor).

By using a thin magnetic lens spectrometer in conjunction with an electrostatic field, the positive particle from the radioactive decay of the neutron has been identified as a proton. The source of neutrons was a beam from the Chalk River pile from which the pile γ rays had been filtered by a 5-in. bismuth plug at the reacting core end of the collimator. The protons produced in the beam were focused on the plate of an electron multiplier, and the half-life of the neutron decay could be estimated from the counting rate of the electron multiplier and the geometry of the experiment. This half-life was found to lie between 9 and 25 min.

4051 Random Sampling (Monte Carlo) Techniques in Neutron Attenuation Problems. II. Herman Kahn. Nucleonics 6, No. 6, 60-5(1950) June. (See also NSA 4-3795.)

The number of neutron life histories in a Monte Carlo calculation can be reduced from 10^9 to about 10^3 by four special techniques. Two of them, quota sampling and statistical estimation, are described in this article. It is pointed out that large errors can be introduced when the quota sampling is faulty, and large areas of importance may be missed completely in the calculation.

4052 Additional Remarks on the Complex Structure of Particles of Spin 1. Louis de Broglie. Compt. rend. 230, 1434-7(1950) Apr. 17 (in French).

In a recent article (Compt. rend. 230, 1329(1950)) the author has discussed the possibility that particles of spin 1 are complex particles with two constituents of spin ½. The present paper is devoted to an analysis of the spin of the composite particle, considered as a property of the center of mass of the system, and to an interpretation of the probability density of the composite particle as a probability density for the center of mass with the appropriate spin properties.

4053 Angular Dependence of Crystalline Nuclear Resonance Absorption. E. F. Carr and C. Kikuchi. Phys. Rev. 78, 470(1950) May 15 (Letter to the editor).

The authors calculated the radiofrequency absorption for nuclei of spin 1 and of electric quadrupole moment Q as a function of the orientation of the steady magnetic field with respect to the crystalline electric field. In particular, they investigated the consequences of assuming that the nuclei are subject to the interactions of the nuclear magnetic moment with the static crystalline electric field of tetragonal symmetry. It was found that the absorption spectrum consists of 2I components equally spaced and having separations between equal components given by $3DQ(3\cos^2\theta - 1)$, where $D = (\partial^2 V/\partial Z^2)\,[e/4I(2I-1)]$. The component separations $\Delta\nu_{||}$ and $\Delta\nu_{\perp}$ for the steady field parallel and perpendicular, respectively, to the tetragonal axis are in the ratio of 2 to 1, and the spectrum coalesces into a single line when the external magnetic field is inclined at $\theta = \cos^{-1}(3)^{-\frac{1}{2}}$ with respect to the tetragonal axis.

4054 Fine Structure of the Magnetic Resonance Line of Protons in $CuSO_4.5H_2O$. N. Bloembergen. Physica 16, 95-111(1950) Feb.

The magnetic resonance, at 30 Mc, of protons in a single-crystal of $CuSO_4.5H_2O$ consists of a single line about 14 oersteds wide, at room temperature. A splitting of this line into 10 component lines has been observed at low temperatures. The maximum over-all separation at 1.2°K is over 600 oersteds. The position and width of each line are complicated functions of the direction of the externally applied magnetic

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field in the crystal. For each direction of the external field the separations between the lines increase with decreasing temperature. Theoretical formulas for the position of the component lines are developed by considering the proton 2-spin system within a water molecule of hydration immersed in the external field and the inhomogeneous time-averaged field of the cupric ions. Exchange and saturation effects are taken into account up to terms in $1/T^3$. Expressions for the line width are also derived. (auth)

4055 Isotope Shift in the Resonance Lines of Zinc. M. F. Crawford, W. M. Gray, F. M. Kelly, and A. L. Schawlow. Can. J. Research 28A, 138-43(1950) Mar.

The isotopic structures of the Zn(I) resonance lines 2139 A ($4s^2\,^1S_0 - 4s4p_1^{\,1P}$) and 3076 A ($4s^2\,^1S_0 - 4s4p_1^{\,3P}$) excited in an atomic beam source have been resolved with a Fabry-Perot etalon. Shifts in cm^{-1} relative to the Zn^{64} component are +0.016 and +0.033 in 2139 A, and +0.023 and +0.046 in 3076 A for Zn^{66} and Zn^{68}, respectively. When the normal mass shifts are subtracted, the residual shifts for Zn^{68} are +0.010 (2139 A) and +0.030 cm^{-1} (3076 A). The field effect theory of isotope shift predicts equal shifts, and the specific mass effect predicts unequal shifts for the ^1P and ^3P levels. Therefore the difference of these residuals is a specific mass effect. The difference has the sense predicted by the specific mass theory and its value, 0.020 cm^{-1}, is a large fraction of the observed shifts. Thus the specific mass effect must be taken into account before the field effect theory can be used to obtain nuclear properties from isotope shifts in intermediate elements. 23 references. (auth)

4056 Isotope Shift in the Spectrum of Neutral Lead. Thurston E. Manning, C. E. Anderson, and W. W. Watson. Phys. Rev. 78, 417-19(1950) May 15.

The isotope shift and the Pb^{207} h.f.s. in one of the strongest Pb(I) lines in the violet and ultraviolet regions have been measured, using material enriched in the 204 isotope. For all lines with measurable structure the 204 to 206 interval is less than the 206 to 208 interval. In the resonance line λ2833 and in λ3639, for both of which the measurements are almost completely unaffected by superposed h.f.s., the ratio of the 204 to 206 to the 206 to 208 interval is 0.89 and 0.82, respectively. The average of the observations for the staggering of the center of gravity of the 207 components for all lines is about 0.63 for the ratio of the 206 to 207 and 207 to 208 intervals. Isotope splitting of about 0.050 cm^{-1} in the 6p6d levels contributes further evidence of perturbations by 6p7s and 6p8s levels. The staggering is discussed in terms of Breit's theory of polarizability of nuclei by electrons. These Pb isotope shifts indicate decreasing nuclear stability in the progression 204 to 208. (auth)

4057 Magic Numbers and Elements with No Stable Isotopes. Lew Kowarski. Phys. Rev. 78, 477-9(1950) May 15 (Letter to the editor).

An attempt is made to correlate the abnormal instability of all isotopes of Tc and Pm with various features of the nuclear shell model, mainly with the occurrence of the magic neutron numbers 20 and 82. On the basis of this analysis, the author suggests some conditions governing the binding of open-shell neutrons.

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4058 Neutron Binding Energies in Pb^{207}, Pb^{208} and in Bi^{210}. B. B. Kinsey, G. A. Bartholomew, and W. H. Walker. Phys. Rev. 78, 77(1950) Apr. 1 (Letter to the editor).

The energies of the γ rays arising from neutron capture in Pb^{208}, Pb^{207}, and Bi^{209} have been measured with the aid of a coincidence pair spectrometer. The technique of energy measurement has been described briefly in an earlier letter (Phys. Rev. 77, 723(1950)). These energies were found to be: (a) from lead, 6.68 ± 0.04 Mev and 7.37 ± 0.02 Mev; (b) from bismuth, 4.170 ± 0.015 Mev. The author finds that the 6.68- and 7.37-Mev γ's must arise from capture in Pb^{208} and Pb^{207}, respectively, and represent the neutron binding energies in Pb^{207} and Pb^{208}, respectively. The 4.17 Mev represents that of Bi^{210}. The neutron binding energy of Pb^{209} may be deduced from the present results, the energy of the decay of Pb^{209}, and the energy set free in the disintegrations by which RaD (Pb^{210}) passes to Pb^{206}. Values deduced are 4.81 Mev for Pb^{210} and 4.35 Mev for Pb^{209}. The ratio of the thermal neutron capture cross section of Pb^{207} to that of Pb^{206} can be estimated if it is assumed that only transitions to the ground state occur in significant amount. It is estimated that this ratio is about 7.

4059 Nuclear Induction Signals for Long Relaxation Times. E. E. Salpeter. Proc. Phys. Soc. (London) 63 A, 337-49(1950) Apr. 1.

Equations of motion, previously derived by Bloch (Phys. Rev. 70, 460(1946)), for the nuclear magnetic moment in a nuclear induction experiment are applied to the steady state reached when the strong magnetic field H_z is swept sinusoidally about its resonance value. Different approximations for the shapes and sizes of nuclear induction signals are derived for various limiting cases, depending on (a) whether the passage of H_z is "adiabatic" or "extremely nonadiabatic" (very weak radiofrequency field) and (b) whether the relaxation times are shorter or longer than the period of the sweep of H_z. It is found that quite large signals may be induced by even a very weak radiofrequency field if the relaxation times are very long. (auth)

4060 The Nuclear Magnetic Mon[illegible] of Niol um[93]. Robert E. Sheriff, William H. Chambers, and Dudley Williams. Phys. Rev. 78, 476-7(1950) May 15 (Letter to the editor).

The nuclear magnetic resonance absorption peak for niobium 93 was determined in a field of 6300 gauss with a solution of Nb_2O_5 in HF. The ratio of the Nb^{93} resonant frequency to that of B^{11} determined under the same conditions was found to be $\nu\,(Nb^{93})/\nu\,(B^{11}) = 0.76187 \pm 0.00040$, on the basis of which the authors calculate the magnetic moment of Nb^{93} to be $\mu\,(Nb^{93}) = 6.1659 \pm 0.0032$ nuclear magnetons.

4061 The Nuclear Magnetic Moment of Praseodymium[141]. William H. Chambers, Robert E. Sheriff, and Dudley Williams. Phys. Rev. 78, 482-3(1950) May 15 (Letter to the editor).

By means of a superregenerative oscillator technique, a nuclear magnetic resonance absorption peak for Pr^{141} has been located. By comparison of the resonance peak with the sodium resonance peak observed simultaneously in the same magnetic field, the following tentative value for the ratio of the resonance frequency of Pr^{141} to the resonance frequency of Na^{23} in sodium borate in the same applied field was obtained:

$\nu(Pr^{141})/\nu\ (H^1) = 0.32698 \pm 0.00016$

Making use of this result, the authors calculate the magnetic moment to be

$\mu(Pr^{141}) = 4.5938 \pm 0.0023$ nuclear magnetons

4062 Nuclear Mass Determinations from Nuclear Q-Values. A. Tollestrup, W. A. Fowler, and C. C. Lauritsen. Phys. Rev. 78, 372-4(1950) May 15.

Consistent values of the masses of the light nuclei have been calculated from the best measurements of Q-values for several nuclear reactions and from mass-spectrographic measurements. Tables are given of the Q-values and of the calculated mass values. (auth)

4063 Nuclear Specific Heats in Paramagnetic Salts. B. Bleaney. Phys. Rev. 78, 214-15(1950) May 1.

This paper considers theoretically the contribution to the specific heat arising from the hyperfine structure, i.e., from the interaction of the magnetic moment and electric quadrupole moment of the nucleus with its surroundings. This contribution is important only at low temperatures, where it is approximately of the form A/T^2. The coefficient A is calculated for a number of copper, manganese, and cobalt salts. Agreement with the limited amount of experimental data available is reasonably good. The influence of the hyperfine structure on the magnetic susceptibility is negligible unless the temperature is exceedingly low, for even in single crystals it begins only with terms of the third order in 1/T. In manganese ammonium sulfate the electronic Stark splitting deduced from paramagnetic resonance at 20 and 90°K does not agree with that obtained from the paramagnetic anisotropy between 90 and 300°K. (auth)

4064 On Completed Shells of Neutrons and Protons in Atom Nuclei. I. A. Vaĭsman. Doklady Akad. Nauk S.S.S.R. 71, 859-62(1950) (in Russian).

The author questions the adequacy of the attempts, made by several writers, to limit the numbers of protons in nuclei having completed proton shells to the series of "magic numbers" 2, 8, 20, 50, and 82, to which, in the case of neutron shells, the number 126 is added. He supplements both series with certain other numbers, basing his argument on the nonexistence in nature of certain stable nuclei or certain α emitters. His list shows the following numbers of protons in nuclei with completed proton shells: 2, 8, 14, 20, 26, 38?, 42, 50, 56, 60, 74, 82; the numbers of neutrons in nuclei with completed neutron shells are: 2, 8, 18, 20, 34, 38, 44, 50, 60, 82, 88, 114, 122, 128, 138. The relationships involved here acquire visual clearness when the author's representation of the periodic table of isotopes is used: this table marks the points in which the increase in the number of neutrons changes periodically from 1 to 2, then again to 1, when the number of neutrons steadily increases by one neutron; these points determine inflexions in the band on which the isotopes are inscribed. On such a table, some of the nonexisting stable isotopes occupy certain line segments, whose position coincides with that of the above inflexions; they seem to mark both the just preceding closing of a (neutron or proton) shell and the immediately following transition to a new type of nuclear structure. Other segments of nonexisting

isotopes occupy intermediate positions along the band; they mark the completing of other shells and the occurrence of other energy changes within the nucleus.

4065 On the Magnetic Moments of Xe^{129}, Bi^{209}, Sc^{45}, Sb^{121}, and Sb^{123}. W. G. Proctor and F. C. Yu. Phys. Rev. 78, 471(1950) May 15 (Letter to the editor).

Various nuclear magnetic resonances were observed by means of a nuclear induction spectrometer described previously (Phys. Rev. 75, 522(1949)). The following results were obtained:

Nucleus	Nuclear moment in nuclear magnetons	Diamagnetic correction, %
Xe^{129}	-0.7726 ± 0.0001	0.56
Bi^{209}	$+4.0400 \pm 0.0005$	1.04
Sc^{45}	$+4.7497 \pm 0.0008$	0.15
Sb^{121}	$+3.3427 \pm 0.0005$	0.52
Sb^{123}	$+2.5341 \pm 0.0003$	0.52

4066 On the Nuclear Spin of B^{10}. M. T. Weiss, M. W. P. Strandberg, R. B. Lawrance, and C. C. Loomis. Phys. Rev. 78, 202-4(1950) May 1.

From measurements on the fine structure of the $J = 0 \rightarrow 1$ rotational transition of $H_3B^{10}CO$ near 17,960 Mc/sec the authors are able to establish that the spin of B^{10} is 3, as had previously been reported by Gordy, et al. (Phys. Rev. 74, 1191(1948)). A quadrupole coupling constant of 3.44 ± 0.1 has also been determined for this molecule. A brief description of the spectroscope employed is included. (auth)

4067 The Polarization of Beta Rays Emitted by Oriented Nuclei. Hendrik A. Tolhoek and Sybren R. De Groot. Compt. rend. soc. biol. 230, 1580-2(1050) May 3 (in French).

The application of strong magnetic fields to substances at low temperatures may, in some cases, result in an appreciable orientation of the nuclei. The author has considered the effect of such orientation on the spin of β particles emitted, by β-active substances, in permitted transitions. These considerations indicate the possibility of a new method of measuring the magnetic moment of radioactive nuclei. (auth)

4068 Relative Nuclear Moments of H^1 and H^2. E. C. Levinthal. Phys. Rev. 78, 204-13(1950) May 1.

An accurate determination of the relative moments of the proton and the deuteron has been carried out, using the techniques of nuclear induction, together with a measurement of the spin and the sign of the deuteron moment. The different line shapes of the proton and deuteron signals have been explained in terms of relaxation times and spins. Symmetrical signals have been obtained by a systematic way of introducing a homodyning signal of the correct phase. The symmetry of the separate and superimposed signals and hence the occurrence of resonance at a common value of the d-c magnetic field were determined by photographic analysis. The ratio of the moments of proton and deuteron has been found to be $\mu P/\mu D = 3.257204 \pm 0.000015$ or $\mu D/\mu P = 0.3070117 \pm 0.0000015$. The facts that the spin of the deuteron is j = 1 and that the sign of its magnetic moment is positive have been verified. (auth)

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4069 The Schmidt Model and Odd-Even Staggering of the Isotopic Shift. G. Breit. Phys. Rev. 78, 470(1950) May 15 (Letter to the editor).

Centroids of the hyperfine structure patterns of isotopes with odd A and even Z usually fall between the lines of isotopes with even N and closer to those of the lighter even isotope. This phenomenon is referred to as the odd-even staggering. An explanation of it has been proposed in terms of nuclear polarization, which involves assumptions about nuclear wave functions and leaves room for the consideration of other effects with which it might combine. The author here examines the bearing on the even-odd staggering of the Schmidt model of the nucleus (Z. Physik 106, 358(1937)), which accounts for features of nuclear magnetic moments on the single-nucleon-plus-core picture.

4070 Spectroscopy of Some Artificially Radioactive Nuclei. Allan C. G. Mitchell. Revs. Modern Phys. 22, 36-55 (1950) Jan.

The energy levels of 52 product nuclei are given, with information on some 60 β and γ disintegrations on which these energy levels are based. The radioactive transmutations, with the decay periods from which the information is derived, are also tabulated. Complete disintegration schemes appearing later than July 15, 1949, are not included. In compiling the energy-level diagrams and disintegration schemes, the author has tried to limit himself to information obtained with the help of β-ray spectrographs of various types. In most of the material used the original investigators measured both the γ-ray spectrum and the β-ray spectrum. In no case are schemes included which are based solely on absorption measurements or β- and γ-γ coincidence measurements. Level schemes based on cloud-chamber measurements were not considered accurate enough for this survey. 136 references.

4071 The Uranium Pile. Terence Price. Atomics 1, 99-106(1950) Apr.

This is a review of various physical and engineering problems involved in the construction and operation of a uranium pile. Special topics discussed include the fission process, the reproductive cycle in a natural uranium pile, the choice of a moderator, elementary pile theory, delayed neutrons, the design of control rods, safety systems, and heat removal. Some remarks are devoted to piles constructed in Great Britain.

4072 Nuclear Cross Sections for 270 Mev Neutrons. II. James DeJuren. AECD-2854, Jan. 26, 1950. Decl. May 22, 1950. 12p.

The total cross sections of 11 different elements were measured for the neutrons resulting from the bombardment of a 2-in. Be target by the 350-Mev protons of the 184-in. cyclotron. Bismuth fission ionization chambers served as the neutron detectors and had an estimated mean neutron detection energy of 270 Mev for the measurements. The attenuating materials were placed inside the concrete shielding, and the monitor was placed to one side of the attenuators. The detector was placed about 30 ft from the attenuators, in line with the target and the attenuators. Collimators in the concrete shielding and a concrete block immediately behind the attenuating materials limited the detection of neutrons scattered through small angles to 20 min.

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"Poor" geometry cross sections of carbon, copper, and lead were measured by placing a shallow fission chamber behind attenuators of large cross-sectional area over which the neutron flux was uniform. The inelastic cross section is at least half the total for all 3 elements. (auth)

4073 Carrier-free Manganese-54 from the Pile? Tikvah Alper and Lorene du Preez. Nature 165, 689-90 (1950) Apr. 29 (Letter to the editor).

Radioactive iron obtained from a pile was found to be contaminated with Mn^{54}. This was verified by absorption experiments in aluminum and lead and decay measurements. A spectrochemical investigation of the radioiron solution and of the target material in the pile failed to disclose any trace of manganese. Thus the authors conclude that carrier-free Mn^{54} was produced in the reaction $_{26}Fe^{54}(n,p)_{25}Mn^{54}$.

4074 Delayed Neutrons from U^{238} and Th^{232} Fission. K. H. Sun, R. A. Charpie, F. A. Pecjak, and B. Jennings. Westinghouse Research Laboratories Scientific Paper No. 1498, nd. 12p. (AEC File No. NP-1464.)

The half-lives of the delayed neutron emitters from U^{238} and Th^{232} fission were found to be 0.4, 1.7, 5.8, 22.6, and 55.2 and 0.41, 1.4, 4.4, 20, and 56 sec, respectively, by using fast neutrons from the reaction of 15-Mev cyclotron deuterons on a thick carbon target. These, when compared with those from the slow neutron fission of Pu^{239} and U^{235}, indicate that delayed neutron emitters from fission of Pu^{239}, U^{235}, U^{238}, and Th^{232} are identical. The delayed neutron yield after saturation bombardment was about 8 per 100 fissions. A preliminary survey indicated that the 22- and 56-sec half-lives were also present when LiF or B_4C instead of carbon was used as the cyclotron target for producing faster neutrons. (auth)

4075 Energy Distribution of Fission Fragments from U^{235} and U^{233}. D. C. Brunton and G. C. Hanna. Can. J. Research 28A, 190-227(1950) Mar.

New measurements have been made of the energy distribution of fission fragments. A coincident pulse technique has been used which measures simultaneously the energies of both fragments of a fission pair. Previous work in this field was limited in statistical accuracy owing to low fission rates. With the Chalk River high-flux pile and a 30-channel pulse analyzer, a rapid accumulation of data is made possible. The improved statistical accuracy has led to new results on the detailed association of fragment pairs and on the energy variation occurring in each fission mode. A careful comparison of U^{233} and U^{235} has been made. (auth)

4076 Energy Spectrum of Fragments from the Spontaneous Fission of Natural Uranium. W. J. W. Galbraith. Phil. Mag. 41, 429-43(1950) May.

A direct comparison is made between the energy spectrum of fission fragments from the spontaneous fission and from the thermal neutron-induced fission in the same foils of natural uranium. The results show that, within the limits of the experiment, the two distributions are not significantly different from one another. Calculations are made which indicate the magnitude of the distortion of the energy spectrum to be expected, and the theory is found to agree satisfactorily with experiment. As a subsidiary result to the

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main experiment, the rate for the spontaneous fission of natural uranium is found to be 24.2 ± 1.5/hr/g. (auth)

4077 Excitation Curve for Protons in the Reaction $F^{19}(d,p)F^{20}$. S. C. Snowdon. Phys. Rev. 78, 299-300 (1950) May 1 (Letter to the editor).

The total cross section for the production of protons in the reaction

$$F^{19} + H^2 \rightarrow F^{20} + H^1 \qquad (1)$$

has been investigated in the deuteron energy range 0.7 Mev to 1.8 Mev. In this reaction the residual nucleus decays according to

$$F^{20} \rightarrow Ne^{20} + \beta^- \qquad (2)$$

where the β rays are emitted isotropically. Hence a measurement of the yield of the β rays provides a convenient means of measuring the total cross section of reaction 1. The β-ray yield is also related to the half-life of F^{20}, and the experimental results were found to be inconsistent when the previously reported half-life of 12.4 sec was assumed (Eq. 1). A half-life of 10.7 sec gave very good results, and further measures indicated that this, in fact, is the correct half-life. A plot is given of the cross section for reaction 1 as a function of the deuteron energy.

4078 Neutron Groups from $Be^9(\alpha,n)C^{12}$. C. E. Bradford and W. E. Bennett. Phys. Rev. 78, 302-3(1950) May 1 (Letter to the editor).

A thick beryllium target was bombarded with 1.4-Mev alpha particles. The energies of the neutrons produced in the reaction $Be^9(\alpha,n)C^{12}$ were determined by observing recoil protons in photographic emulsions. A neutron energy spectrum is given which has a main peak at 2 Mev and another at 6 Mev.

4079 Neutrons from the Bombardment of Li^6 by Deuterons. Ward Whaling and J. W. Butler. Phys. Rev. 78, 72-3 (1950) Apr. 1 (Letter to the editor). (See also NSA 2-1392.)

The authors have studied the energy spectrum of neutrons obtained from the following reactions:

$$Li^6 + H^2 \rightarrow Be^7 + n^1 + 3.30 \text{ Mev}$$

$$Li^6 + H^2 \rightarrow He^4 + He^3 + n^1 + 1.68 \text{ Mev}$$

The spectrum was analyzed from cloud-chamber photographs of recoil protons in the direction of the deuteron beam. A target of $Li_2^6SO_4$, 375 $\mu g/cm^2$ (about 150 kev at the bombarding energy used) was irradiated with 595-kev deuterons from the Rice Institute van de Graaff generator. The low bombarding energy was chosen to minimize the neutrons from deuteron bombardment of carbon contamination on the target and on the tube wall in the analyzing magnet. The spectrum curve is reproduced. The shape of the curve gives some indication of the formation of a 435-kev excited state in Be^7, but if this state is formed in the reaction, at the most, 30% of the reactions leave the Be^7 nucleus with this excitation energy. The Q value for the transition to the ground state of Be^7, as determined from the spectrum, is 3.27 Mev. Some discrepancies exist between the results of this experiment and the data previously reported by Mandeville, Swann, and Snowdown (Phys. Rev. 76, 980(1949)).

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4080 Nuclear Reactions of Light Elements. Richard W. Dodge. Westinghouse Engr. 10, 138(1950) May.

The author very briefly compares the energy released in uranium fission with the energy released in various fusion processes and discusses the difficulties involved in constructing a bomb drawing its energy from a fusion process. It is concluded that, while the sudden release of large amounts of energy produced in a fusion process seems possible, a sustained fusion process is impractical.

4081 The Photodisintegration of Carbon into Three Alpha-Particles. F. K. Goward, V. L. Telegdi, and J. J. Wilkins. Proc. Phys. Soc. (London) 63 A, 402-4 (1950) Apr. 1 (Letter to the editor).

Ilford C2 and E1 nuclear emulsions were irradiated with a continuous spectrum of γ rays of approximate peak energy of 25 Mev, and the resulting carbon stars were measured. For each star the incident γ energy was determined from the equation $h\nu = (E_T + 7.3)$ Mev, where E is the sum of the energies of the three α particles produced in the reactions, $C^{12} + h\nu \rightarrow Be^{8*} + He^4$ and $Be^{8*} \rightarrow He^4 + He^4$. From the energy release in 216 stars, an approximate cross section of the process as a function of β-ray energy is deduced, whose maximum is of the order of 10^{-28} cm^2 at about 18 Mev. The angular distribution of the emitted α particles is also given.

4082 Preparation of High Specific Activity Hydrogen Sulphide (H_2S^{35}) from Neutron-Irradiated Potassium Chloride. W. S. Koski. Nature 165, 565-6(1950) Apr. 8 (Letter to the editor).

Neutron-irradiated potassium chloride was put in a quartz container which was first evacuated and then sealed with about 25 cm of hydrogen in it. This container was heated to 1100°C for 3 hr and then permitted to stand overnight at 550°C. Chemical examination of both the gas and solid phase showed that more than 95% of the sulfur activity which was originally present in the solid phase was now in the gas phase, and all of it was in the form of hydrogen sulfide. The author believes that the valence state of the radiosulfur may be affected by the pre-irradiation treatment of the potassium chloride. It appears that the hexavalent sulfur which ordinarily constitutes the bulk of the radiosulfur produced in such a process is due, at least in part, to oxidation by oxygen occluded in the potassium chloride crystals. If the crystals were made in such a way that oxidizing materials were excluded, then one might expect to find the sulfur in the −2 state. For many purposes radiosulfur in this valence state is highly desirable (Croatto and Maddock, Nature 164, 613 (1949)).

4083 Proton Groups from the Alpha-Particles Bombardment of Beryllium. William O. McMinn, M. B. Sampson, and M. Loren Bullock. Phys. Rev. 78, 296-7 (1950) May 1 (Letter to the editor).

Bombardment of a 0.23 mg/cm^2 surface density metallic beryllium target with 21.94 Mev α particles from the cyclotron has produced 4 proton groups. The authors have calculated Q-values for the reaction $Be^9(\alpha,p)B^{12}$ and 3 energy levels of B^{12} and have obtained a value for the mass of B^{12}. Protons emerging from the target at 90 deg from the incident beam were counted by means of a dual proportional counter in a coincidence and discriminator circuit as de-

scribed by Brolley, Sampson, and Mitchell (Phys. Rev. 71, 32(1947)). The pulse discriminator was adjusted so that only pulses were counted which corresponded to the peak of the Bragg curve. Proton energies were calculated from aluminum absorption. The atomic mass of B^{12} turns out to be 12.01839, and the Q-values and energy levels are tabulated.

4084 Recoil Coincidence-Absorption Measurement of Neutron Spectra from the Reactions $A^{40}(d,n)$ and $N^{15}(d,n)$. Donald C. Worth. Phys. Rev. 78, 378-81(1950) May 15.

A counter method offering a more convenient and flexible measurement of neutron energy in the medium- to high-energy range is further described. Experimental results obtained by the application of this method to the reactions $A^{40}(d,n)$ and $N^{15}(d,n)$ are given. For the argon reaction, Q-values of 5.97, 4.63, 2.87, and 1.57 Mev were observed. The K^{41}-A^{40} mass difference was thus observed to be 0.99936 ± 0.00027 mass units. For the nitrogen reaction, Q-values of 10.9, 4.8, 1.6, and 0.2 Mev were observed, the last value being in some doubt. (auth)

4085 Transitions to the Ground States in Nuclei Excited by Slow Neutron Capture. B. B. Kinsey, G. A. Bartholomew, and W. H. Walker. Phys. Rev. 78, 481-2 (1950) May 15 (Letter to the editor).

An investigation was made by means of a pair spectrometer of the γ radiations resulting from transitions from the capturing states to the ground states of product nuclei, produced by the capture of slow neutrons in the elements Be, C, N, Pb, and Bi. The intensities were determined by correcting the peak coincidence counting rate for the pair-formation cross section and its angular distribution.

4086 Electron-Optics of the Betatron. E. Schwartz. Z. Naturforsch. 4a, 198-204(1949) June (in German).

The paths of electrons for the first few revolutions after injection are determined for a divergent electron beam. The acceptance time increases with injection voltage and flatness of the magnetic field. The acceptance angle increases with flatness of magnetic field and is independent of injection voltage, and during the injection interval it rises from zero to a maximum and falls back to zero again.

4087 Operation of a 300-Mev Betatron. D. W. Kerst, G. D. Adams, H. W. Koch, and C. S. Robinson. Phys. Rev. 78, 297(1950) May 1 (Letter to the editor).

Geiger-counter yield trials of the new University of Illinois betatron were successful on the first attempt. The results of these yield trials are described. The ease with which good yield was obtained is attributed largely to freedom from disturbing magnetic and electrostatic bumps at injection time. The following design features, among others, were important in this respect: (1) The circular pole faces are continuous except for ⅛-in. spacers between field magnets. This minimizes field lag at these joints. (2) Each of the 6 field magnets is constructed of identical ½-in. bundles of laminations. This ensures that each bundle is carried through the same magnetic cycle, resulting in azimuthal uniformity of residual magnetic field and of field lag due to eddy currents. (3) Large eddy currents were prevented by 0.005-in. Kraft paper every ¼ in. in the stacking of the flux

core and of the field magnets. Other operating characteristics and design features are discussed.

4088 Absorption Bands and Luminescence of LiF Irradiated at Low Temperature. Peter Pringsheim and Philip Yuster. Phys. Rev. 78, 293(1950) May 1 (Letter to the editor).

The absorption spectrum of x-irradiated LiF crystals at different temperatures and the relationships between the luminescence spectrum and the absorption bands and bleaching light are shown by curves.

4089 Concerning the Theory of Ferromagnetic Resonance Absorption. J. H. Van Vleck. Phys. Rev. 78, 266-74 (1950) May.

The first part of this paper gives a simple quantum-mechanical derivation of Kittel's formula (Phys. Rev. 73, 155(1948)) for the resonance frequency of ferromagnetic materials. The interaction between the elementary dipoles are handled directly, rather than through the *ad hoc* introduction of macroscopic demagnetization factors, as is usually done. In Sec. 3 Kittel's corrections for the effect of anisotropy on frequency are derived from the microscopic standpoint with a model having quadrupolar coupling between atoms. Section 4 discusses qualitatively the effect of exchange narrowing on the line width. In Sec. 5 it is shown that Kittel's relation $g - 2 = 2 - g'$ (Phys. Rev. 76, 743(1949)) connecting the spectroscopic splitting factor g and the gyromagnetic ratio g' is a general consequence of first-order perturbation theory. Throughout the paper it is stressed that ferromagnetic bodies may have important short-range forces of dipolar structure which arise from anisotropic exchange rather than from true magnetic coupling. It is shown that in the first approximation, inclusion of these anomalous forces does not modify Kittel's results. (auth)

4090 Dipole Transitions in the Nuclear Photo-Effect. J. S. Levinger and H. A. Bethe. Phys. Rev. 78, 115-29(1950) Apr. 15.

Sum rules are applied to calculate with certain approximations the integrated cross section and the mean energy for photon absorption by heavy nuclei. The mean energy is ⅓ of the average kinetic energy of a nucleon for pure ordinary forces, or about 19 Mev, and is greatly increased by an attractive exchange force. The "harmonic mean" energy is much too low when the uncorrelated nucleon model is used, but is reasonable for the α-particle model of the nucleus. A sum rule for quadrupole transitions is developed, and it is shown that they can account for only about 6% of the experimentally observed integrated cross section. The sum rules for dipole transitions are applied to the photodisintegration of the deuteron, and a comparison is made with direct calculations of the cross section. The asymptotic behavior of the cross section for dipole transitions of high photon energies is determined by the nature of the singularities in the neutron-proton potential. Finally, recent experiments (Lawson and Perlman, Phys. Rev. 74, 1190(1948); Baldwin and Klaiber, 73, 1156(1948)) on the cross section for photodisintegration and its energy dependence are discussed, and it is shown that the authors' calculations explain the general features of these experiments so that it is not necessary to assume the Goldhaber-Teller model of dipole vibrations by the entire nucleus. (auth)

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4091 Energy Loss of Fast Electrons in Be, C, H_2O, Fe and Pb. W. Paul and H. Reich. Z. Physik 127, 429-42 (1950) (in German).

Electrons were accelerated in a betatron to energies ranging from 2.8 to 4.7 Mev. The energies of these electrons were measured by means of a β-ray spectrograph both before and after their passage through a layer of matter. The energy spectra obtained with the spectrograph were strongly dependent on the atomic number of the layer of matter traversed and on the initial energy of the electrons. The mean energy loss determined from the energy spectra was compared with that predicted by the theories of Bethe and Bloch and of Halpern and Hall, of which the latter is in better agreement with the experimental results.

4092 Momenta in Atoms using the Thomas-Fermi Method. C. A. Coulson and N. H. March. Proc. Phys. Soc. (London) 63A, 367-74(1950) Apr. 1.

The Thomas-Fermi statistical theory of the free atom is used to calculate the momentum distribution and the shape of the Compton profile for x-ray scattering, the results being expressed in dimensionless form applicable to all atoms. The mean momentum, which varies as $Z^{2/3}$, where Z is the atomic number, agrees well with more accurate wave-mechanical calculations. Numerical results are also reported for argon and krypton, using the Dirac modification of the original theory, in which exchange effects are taken into account and the atom has a finite radius. Agreement with experiment is not noticeably better with these refinements. (auth)

4093 On the Penetration of 17 Mev Electrons. M. Ageno and M. Chiozzotto. Rend. ist. super. sanità 11, (Part 6) 1472-88(1948)(in Italian).

A similar article appeared in Nuovo cimento 6, 81(1949) and was abstracted in Nuclear Science Abstracts as Abstract 3-1600.

4094 On a Well-Known Cross-Section Theorem. Melvin Lax. Phys. Rev. 78, 306-7(1950) May 1 (Letter to the editor).

Any collision process that removes particles from an incident beam must be accompanied by a forward scattering whose function is to interfere with the main beam and produce a shadow. This theorem has been proved for a variety of special cases (Wick, Phys. Rev. 75, 1459(A) (1949)). The author indicates a proof general enough to include all the following special cases: (1) inelastic as well as elastic scattering; (2) creation and destruction of particles; (3) forces of any type—including spin-dependent and noncentral forces; (4) nonconservative forces, i.e., nonhermitian operators.

4095 The Relative Stopping Power of Metals for 12-Mev Protons. John G. Teasdale. University of California at Los Angeles, Dec. 20, 1949. 17p. (AEC File No. NP-1368).

A sensitive method for comparing the stopping powers of metals has been developed for use with the external proton beam of the cyclotron at UCLA. The procedure was especially designed for the use of thin foils in connection with high-energy charged particles, but it may be adapted to the use of gases. The comparison of two metals was made by arranging the foils of the respective metals into two stacks so that each produced the same energy loss when inserted into the proton beam. A null method was used in which the energy of the proton beam was monitored with one stack in the beam; the thickness of the other stack was then varied until substituting it for the original stack did not change the energy. In this null method a differential ionization chamber was used in which the ionization currents from two adjacent sections could be balanced against one another. When used in connection with an electrometer tube, the differential ionization chamber enabled the detection of a change in absorbing material of 0.1 mm/cm^3 of aluminum equivalent for a proton beam current of the order of 10^{-14} amp. The metals nickel, copper, rhodium, palladium, silver, cadmiun, indium, tantalum, platinum, gold, and thorium were compared with aluminum, and the relative mass stopping powers were determined for a mean proton energy of 12 Mev. The accuracy of the results was estimated to correspond to about 1% standard error. The limits of the accuracy were set by the variations in the thicknesses of the foils and by the fluctuations in energy and intensity which were characteristic of the deflected proton beam. The values of the relative stopping power per electron were calculated from the relative mass stopping powers, and these showed a linear relation with respect to the logarithm of atomic number within the limits of the errors of the measurements. The experimental values for thorium showed some tendency to be slightly higher than that determined from a linear relationship. The accuracy of the results, however, was not sufficient to confirm definitely the deviation of thorium as reported by Kelly (Phys. Rev. 75, 1006(1949)). The Bloch constant was evaluated from the linear relation between the relative stopping power per electron and the logarithm of atomic number. A value of 9 ± 1.5 ev was obtained which is considerably lower than the value of 11.5 ev reported by R. R. Wilson (Phys. Rev. 60, 749(1941)). The results of this investigation, particularly the value of the Bloch constant, will make possible a more accurate evaluation of the range-energy relation for protons. (auth)

4096 Saturation Backscattering of Positive Electrons. H. H. Seliger. Phys. Rev. 78, 491-2(1950) May 15 (Letter to the editor).

The percentage backscattering of positive electrons from a source backing thick enough to ensure complete absorption of the β particles has been determined. It was found that the backscattering of the positrons emitted by Na^{22} was consistently 30 to 40% lower than that of electrons from I^{131}, RaE, and P^{32}, although the geometrical conditions were the same.

4097 Short Range Alphas in Natural Radioactivity. S. M. Dancoff. AECD-2853, nd, Decl. May 23, 1950. 25p.

The purpose of this paper is to consider from a theoretical standpoint the fine structure of the α particles emanating from naturally radioactive nuclei. The long-range α particles emitted from an excited nucleus before decay to its ground state are not considered. Only the particles whose energy is less than would correspond to a transition between ground states of the parent and daughter nuclei are studied. The following methods whereby such an α particle can suffer energy loss are considered: (a) bremsstrahlung

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during ejection by the parent nucleus; (b) bremsstrahlung due to deflection by a nucleus along the trajectory; (c) excitation of the residual nucleus. Process (c), which is the most important, and from a theoretical viewpoint the most interesting, is treated in the greatest detail.

4098 Bremsstrahlung Spectrum from Very Thick Sources. M. E. Rose. ORNL-697, May 10, 1950. 13p.

The case considered here is one where it is necessary to work with large amounts of radioactive material, and adequate shielding from the consequent x-rays is required. An upper limit determination of the intensity and spectral distribution of the radiation, which is sufficiently accurate so as not to grossly overestimate the radiation energy emitted, is then essential. A quantitative description of the multiple bremsstrahlung process is presented. The results given are most practical and easily applied when the relative probability of a radiative collision as compared to a nonradiative collision is small. This will be the case for electron energies in the β-particle range and smaller and for not too heavy elements. Numerical results are not included.

4099 Isomerism in Co^{58}. Karl Strauch. UCRL-659, Apr. 17, 1950. 14p.

An isomer of Co^{58} has been identified which decays with a half-life of 8.8 hr by emission of a 24.9 ± 1.0 kev γ ray. The ratio of the K and L conversion coefficients was 1.9 ± 2. The relative cross section for formation of the isomeric and ground state of Co^{58} by α-particle bombardment of manganese was found to be 1.7. The conversion coefficient of the 805-kev γ ray of Fe^{58} was 2.5×10^{-4}. Possible decay schemes are presented. A carrier precipitation method was used to separate the cobalt from the other activities present after sample bombardment. 11 references. (auth)

4100 Radioactive Isotopes of Barium. Richard W. Fink and D. H. Templeton. UCRL-661, Apr. 21, 1950. 4p.

The document is not an abstract; it is reproduced below in its entirety.

In this letter we report the results of some preliminary experiments concerning neutron-deficient isotopes of barium.

Spectroscopically pure CsCl was bombarded with 85-Mev protons in the 184-in. Berkeley cyclotron for periods of 1 to 3 hours. The induced barium radioactivities, after chemical isolation, were observed with a Geiger counter with a 3 mg/cm^2 mica window. The decay curve showed half-lives of 2.0 ± 0.1 hr and 2.4 ± 0.1 day, as well as longer-lived activity due to the well-known (Seaborg and Perlman, Revs. Modern Phys. 20, 585(1948)) Ba^{131} and its daughter Cs^{131}.

Isolation of cesium from the purified barium (after the 2.0-hr activity had effectively decayed) yielded (Fink et al., Phys. Rev. 77, 614(1950)) a mixture of 31-hr Cs^{129} and 10-day Cs^{131}. Subsequent separations of cesium from the same barium yielded only Cs^{131} at a time when the 2.4-day activity was still present. Thus it is probable that the 2.0-hr activity is Ba^{129} produced by the reaction Cs^{133}(p,5n). The 2.4-day period is not Ba^{127}, otherwise it would produce 5.5-hr Cs^{127} as a daughter. The most probable assignment is Ba^{128} from the (p,6n) reaction, but this assignment lacks direct proof.

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A mass-spectrographic analysis of a purified barium fraction showed a line at mass 129 which was proved to be radioactive by the transfer-plate technique. A second line at mass 128 was too weak to be identified as radioactive. The line at 129 is probably due to the cesium daughter, which had time to grow between the purification and the analysis. Cesium is ionized with the thermal ion source with much greater efficiency than is barium. The mass scale was fixed by means of a small amount of stable Cs^{133} added to the sample.

Ba^{128} decays to Cs^{128}, which is expected to be short-lived (ibid) and to decay to stable Xe^{128}. Our experiments indicate a half-life of 30 min or less. Thus the radiations we observe for the 2.4-day period include those from both the barium decay and the cesium decay. We have observed positrons of energy limit about 3 Mev, electrons of about 0.3 Mev, and gamma rays.

Ba^{129} emits positrons, but we have not characterized its radiations otherwise.

We have learned that E. O. Wiig and C. C. Thomas of the University of Rochester have reached some of these same conclusions independently.

4101 Decay Constants from Coincidence Experiments. T. D. Newton. Phys. Rev. 78, 490(1950) May 15 (Letter to the editor).

The mathematical form of delayed coincidence resolution curves in investigated. The results obtained are applicable to high-speed coincidence circuits, as developed by R. E. Bell and H. E. Petch (Phys. Rev. 76, 1409(1949)) and used to study half-lives of the order of 10^{-9} sec.

4102 Disintegration Scheme of In^{116}. Hilding Slätis, Stefan J. du Toit, and Kai Siegbahn. Phys. Rev. 78, 498 (1950) May 15 (Letter to the editor).

Slow neutrons produce two beta-active isomers in indium with mass number 116 and half-lives of 13 sec and 54 min. The results of a detailed study of the β and γ radiation emitted during the disintegration of these isomers are presented here. A complete disintegration scheme is suggested.

4103 Gamma Rays from Terbium 160. J. M. Cork, C. E. Branyan, W. C. Rutledge, A. E. Stoddard, and J. M. LeBlanc. Phys. Rev. 78, 304(1950) May 1. (Letter to the editor).

An energy-level scheme for Dy^{160}, following β emission from Tb^{160}, is based on 12 γ-ray energies derived from energies of conversion electrons and Pb photoelectrons.

4104 Measurement of a Second Half-Life in Yb^{170}. R. E. Bell and R. L. Graham. Phys. Rev. 78, 490-1(1950) May 15 (Letter to the editor).

The half-life of the 83-kev transition in Yb^{170} has been measured as $(1.60 \pm 0.2) \times 10^{-9}$ sec by delayed coincidence techniques, with the coincidence apparatus of Bell and Petch (Phys. Rev. 76, 1409(1949)). The experimental data were analyzed by the methods of Newton (Phys. Rev. 78, 490(1950)) and Bay (Phys. Rev. 77, 419(1950)).

4105 The Natural Activity of Lanthanum. R. W. Pringle, S. Standil, and K. I. Roulston. Phys. Rev. 78, 303-4 (1950) May 1 (Letter to the editor).

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The natural radioactivity of La^{138} was investigated by means of a very sensitive scintillation γ-ray spectrometer. On the basis of their experiment the authors propose a decay scheme, according to which La^{138} goes by K-capture into an excited state of Ba^{138}. The transition from this excited state to the ground state of Ba^{138} takes place with emission of an 1.05-Mev γ ray. The possibility of a simultaneous β decay from La^{138} to Ce^{138} is also indicated. The half-life of La^{138} is estimated to be $\leq 1.2 \times 10^{11}$ years.

4106 Numerical Evaluation of the Fermi Beta-Distribution Function. I. Feister. Phys. Rev. 78, 375-7 (1950) May 15.

In making a Fermi-Kurie plot of a β spectrum, various approximations have been used to evaluate the Fermi distribution $f(Z,\eta)$, where Z is the charge of the residual nucleus and $\eta = Hp/1704$ is the momentum of the emitted rays. It is probable, however, that none of these approximations are completely adequate for all values of Z and η. Hence an accurate computation and tabulation of this important function are now in preparation. Three approximations for $f(Z,\eta)$ are compared with some representative values of $f(Z,\eta)$ that have been computed for the proposed table, and the accuracy and range of validity of these approximations are indicated.

4107 On the Determination of the Relative Positron Activity of Cu^{64} in a Source of Cu^{61}. C. Sharp Cook and Chia-Hua Chang. Phys. Rev. 78, 171-2(1950) Apr. 15 (Letter to the editor).

Previous studies of the positron spectrum of Cu^{61} (C. S. Cook, Phys. Rev. 74, 227(1948); Owen and Cook, ibid., 76, 1536(1949)) were made on the assumption that any other activity in the source was of negligible proportions. Since these sources were prepared by deuteron bombardment of nickel, the question arose whether a certain amount of β-active Cu^{64} was also produced from the Ni^{64} isotope by a (d,2n) reaction. In order to determine the amount of Cu^{64} present, the authors observed the decay of the Auger electrons by means of a lens-type magnetic spectrometer over a period of more than 24 hr following the removal of the nickel target from the cyclotron. The Auger line was found to consist of 99.23% of the 3.33-hr Cu^{61} and 0.77% of the 12.8-hr Cu^{64}.

4108 Probabilities of Beta Decay and Orbital Electron Capture for the Forbidden Transitions. Seitaro Nakamura, Soei Sima, and Minoru Kobayasi. J. Phys. Soc. Japan 4, 166-72(1949) Mar.-Apr.

Total probabilities for β decay and orbital electron capture are calculated according to the Fermi theory in the case of the first and the second forbidden transitions. In this case the ratio of the probability for β^+ emission to those for K-electron capture is also estimated as a function of the nuclear charge and the nuclear radius. (auth)

4109 Radioactivity in Hafnium. J. M. Cork, A. E. Stoddard, W. C. Rutledge, C. E. Branyan, and J. LeBlanc. Phys. Rev. 78, 299(1950) May 1 (Letter to the editor).

The authors have investigated the radioactivity in Hf^{181} produced by slow neutrons and have succeeded in evaluating accurately the energies of many electron lines previously reported. They also have observed several new electron lines. The energies of the lines, which have their origin in internal conversion processes, and photo-emission processes in lead are tabulated. Many, but not all, of the lines have been identified, and their origins are listed. A previously unreported 10.2-hr half-life activity was found in the pure hafnium specimens. This activity was attributed to β decay, followed by γ emission from the daughter nucleus, Ta^{18}. Five gammas were found, whose energies appear to fit very well into the term scheme for tantalum proposed by Wiedenbeck and Chu (Phys. Rev. 75, 226(1949)). The possible origins of the unidentified lines are discussed.

4110 The Analytic Connection Between the Elements of the Scattering Matrix and the Discrete Stationary States in the Heisenberg S-Matrix Theory. Karl Wildermuth. Z. Physik 127, 85-91(1949) (in German).

For a single particle in a central field of force the S-matrix can be brought into diagonal form by the use of wave functions which are functions of the absolute value of the momentum K. The eigenvalues of the S matrix are analytical functions of K, and therefore of the energy. Discrete energy states of the system are obtained by continuation of K on the positive imaginary axis and determination of those K-values for which the analytic continuation of the incident wave vanishes. There are, however, potential functions for which one obtains redundant poles on the imaginary axis, which do not correspond to any energy eigenstate. A method is developed here to avoiding the appearance of these redundant poles. In the transition to negative energy states in the analytic continuation of the S-matrix certain square roots occur whose sign is undetermined. (The S-matrix has a branch point at the origin.) To determine these signs it is necessary to know the S-matrix not only on the positive real energy axis, but also in the infinitesimal neighborhood of this axis. If this condition is fulfilled, the stationary states of a system are given uniquely by the S-matrix in the continuum.

4111 The Analytical Properties of the Asymptotic Wave Function and the Corresponding S- and η-Matrices for Several Particles. I. Karl Wildermuth. Z. Physik 127, 92-121(1949) (in German).

The author constructs the S-matrix for a one-dimensional many-body problem in first approximation. He then discusses the relation between the matrix elements for pure scattering and the matrix elements which include, in addition, ionization effects and the creation of particles. The paper includes a derivation of the second approximation of the S-matrix for the above-mentioned special case and a discussion of the general analytical properties of the exact S-matrix as well as of the η-matrix, related to the S-matrix by the equation $S = e^{i\eta}$.

4112 The Analytical Properties of the Asymptotic Wave Function and the Corresponding S-Matrix for Several Particles. II. Karl Wildermuth. Z. Physik 127, 122-52(1949) (in German).

The S-matrix is set up for a three-dimensional many-body problem. The relation between the various matrix elements is discussed, and a method is given which permits the calculation of all S-matrix elements from the elements of the matrix describing the scattering of free particles by each other.

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4113 Electronic Wave Functions. II. A Calculation for the Ground State of the Beryllium Atom. S. F. Boys. Proc. Roy. Soc. (London) 201 A, 125-37(1950) Mar. 7.

An approximate wave function expressed in terms of exponential functions, spherical harmonics, etc., with numerical coefficients has been calculated for the ground state of the beryllium atom. Judged by the energy criterion, this gives a more accurate result than the Hartree result which was the best previously known. This has been calculated as a trial of a fresh method of calculating atomic wave functions. A linear combination of Slater determinants is treated by the variational method. The results suggest that this will provide a more powerful and convenient method than has previously been available for atoms with more than two electrons. (auth)

4114 Energy Levels and Thermodynamic Properties of the Internal Rotator. J. O. Halford. J. Chem. Phys. 18, 444-8(1950) Apr.

To facilitate the calculation of the thermodynamic properties of internal rotators lying outside the limits of available tabulations, methods of determining the energy levels are studied for the purpose of finding the most expeditious route to accurate results. It proves to be unnecessary in any case to calculate many levels from the wave mechanics. A partition function is set up in terms of the correct ground state and a series of approximate levels derived from the old quantum theory, and this is corrected to constancy by the successive substitution of correct levels, starting with the first excited state. A set of levels obtained in this way which gives the correct partition function always leads to correct values of all the thermodynamic properties. To obtain accurate energy levels, the continued fractions of Koehler and Dennison (Phys. Rev. 57, 1006(1940)) are recommended as most convenient. (auth)

4115 General Operator Field Equations Derived from a Variation Principle. Construction of "Divergence-Less" Four-Vector Operator. Christopher Gregory. Phys. Rev. 78, 479(1950) May 15 (Letter to the editor).

Commutator equations for fields can be derived from a variational principle. A Lagrangian is constructed by replacing the classical space-time derivatives of the field variables by $i/\hbar$ multiplied into the respective commutators of the displacement operators and the field variables. The operator field equations are obtained by making the first variation of the trace of the Lagrangian with respect to the matrix elements of the field variables vanish. The author here generalized this procedure to general invariant functions constructed from four displacement operators and an arbitrary number of field operators, without putting emphasis upon the replacement of partial derivatives by corresponding commutators. It is shown that such a generalized field theory has associated with it a 4-vector operator which satisfies a continuity equation.

4116 Non-Adiabatic Meson Theory of Nuclear Forces. S. M. Dancoff. Phys. Rev. 78, 382-5(1950) May 15.

Two nucleon forces are studied, using a technique with which a detailed account of the nucleon recoil during meson emission and absorption may be given. The nucleon motion is treated relativistically. The method is applied to the neutral scalar meson field. It is concluded that the conventional static approximation gives results for this case which are not misleading. It is pointed out that the concept of potential energy is not always applicable in such problems, its validity depending not so much on the "separation" of the nucleons as on the character of the wave function for the state of the system concerned. (auth)

4117 On a Certain Way of Constructing a Generalized Linear Electrodynamics. V. S. Miliyanchuk. Doklady Akad. Nauk. S.S.S.R. 71, 871-4(1950) (in Russian).

Generalized systems of electrodynamics are usually obtained by way of a relativistically invariant generalization of the Lagrangian function. Another approach is presented here, in which the problem is a construction of such an electrodynamics that, in the case of an electron at rest, would furnish a given static potential. Whereas other systems of linear electrodynamics with higher derivatives deal with static potentials depending on e^{-ar}, the theory discussed here gives potentials which, in a static case, depend on $e^{-a^2r^2}$.

4118 On the Elimination of the Auxiliary Condition in Quantum Electrodynamics. I. Satio Hayakawa, Yonezi Miyamoto, and Sin-itiro Tomonaga. J. Phys. Soc. Japan 2, 172-83(1947) Nov.-Dec.

The authors show how it is possible to eliminate the auxiliary condition in quantum electrodynamics by a relativistic generalization of the idea of transverse and longitudinal components of the field.

4119 On the Elimination of the Auxiliary Condition in Quantum Electrodynamics. II. Satio Hayakawa, Yonezi Miyamoto, and Sin-itiro Tomonaga. J. Phys. Soc. Japan 2, 199-204(1947) Nov.-Dec.

Using the method of a previous paper (J. Phys. Soc. Japan 2, 172-83(1947) Nov.-Dec.), the authors calculate the self-energy of an electron which is introduced as an apparent change in the mass of the electron. The problem of bremsstrahlung is treated as a liberation of the field which has become surplus at the instance of the collision owing to the difference of the self field before and after collision.

4120 Quantum Electrodynamic, Second-Order Corrections to the Current Operator. Thomas A. Green. Phys. Rev. 78, 297-8(1950) May 1 (Letter to the editor).

The author calculates the second-order corrections to the current operator for electrons interacting with noncharged vector mesons, obtaining results for electrodynamics in the limit of vanishingly small meson mass. This procedure was adopted to avoid the difficulties encountered in the quantization of the Maxwell field and to obtain determinate expressions in the infrared terms. The calculation made use of the S-matrix developed from the integral theory based on causality, invariance, and unitarity, proposed by Stueckelberg and Rivier (Helv. Phys. Acta 23, 236(1949)). The results are identical with those of Schwinger (Phys. Rev. 76, 790(1949)) except for a small difference in the infrared terms.

4121 The Radiative Collisions of Positrons and Electrons. J. Katzenstein. Phys. Rev. 78, 161-9(1950) Apr. 15.

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The general matrix elements for the collision of two electrons (e-e case) or a positron and an electron (p-e case) accompanied by the emission of a quantum of radiation are formulated. The two cross sections will differ considerably, both because of the existence of a dipole for the p-e case and because of the essentially different nature of the exchange phenomenon in the p-e case arising there from the possibility of virtual pair creation or annihilation rather than the indistinguishability of the particles. Two cases are calculated in detail, the non-relativistic limit and the extreme relativistic limit. In the former case the cross section for the e-e case is found to vanish if the momentum of the quantum is neglected, while the p-e cross section is comparable to that for the "bremsstrahlung" process. In the latter case the cross sections of the two cases are of the same order of magnitude, the e-e cross section being greater because of the exchange terms, and the exchange terms of the p-e case being negligible in all of the cases considered. (auth)

4122 The Relativistic Mass-Energy Relationship — Has It Been Verified Accurately? S. W. Flugge. Nucleonics 6, No. 4, 67-72(1950) Apr.

It appears that direct measurements of the equivalence between mass and energy are quite inaccurate and that, in evaluating the quantitative validity of the relativistic equivalence principle, certain check methods ought to be considered. Various nuclear reactions, pair production, and annihilation are discussed as potentially accurate checks. Although the data do not give positive proof of its validity, no strong contradiction to the theoretical value is so far known.

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4123 A Variational Method for Non-Conservative Collisions. Melvin Lax. Phys. Rev. 78, 306(1950) May 1 (Letter to the editor).

A variational method is set up which is designed to solve nonconservative quantum-mechanical collision problems. To test the accuracy of the variational expressions used, the dissipative phenomenon of scattering of sound by absorbing material was calculated. Great accuracy was obtained even with very simple trial functions.

4124 A Variational Principle for the Computation of Reflection Coefficients. G. Toraldo di Francia. Phys. Rev. 78, 298(1950) May 1 (Letter to the editor).

It is shown that the quantum-mechanical reflection coefficient of a potential barrier can be calculated by a variational principle. Such a calculation is carried out for a one-dimensional potential barrier; the result is in agreement with that obtained by elementary methods.